the OIL AND GAS JOURNAL
PUBLISHED WEEKLY JANUARY 2, 1961

What's to come in '61

The Journal staff takes a preliminary look at

- ECONOMICS
- OPERATIONS
- POLITICS
- FOREIGN

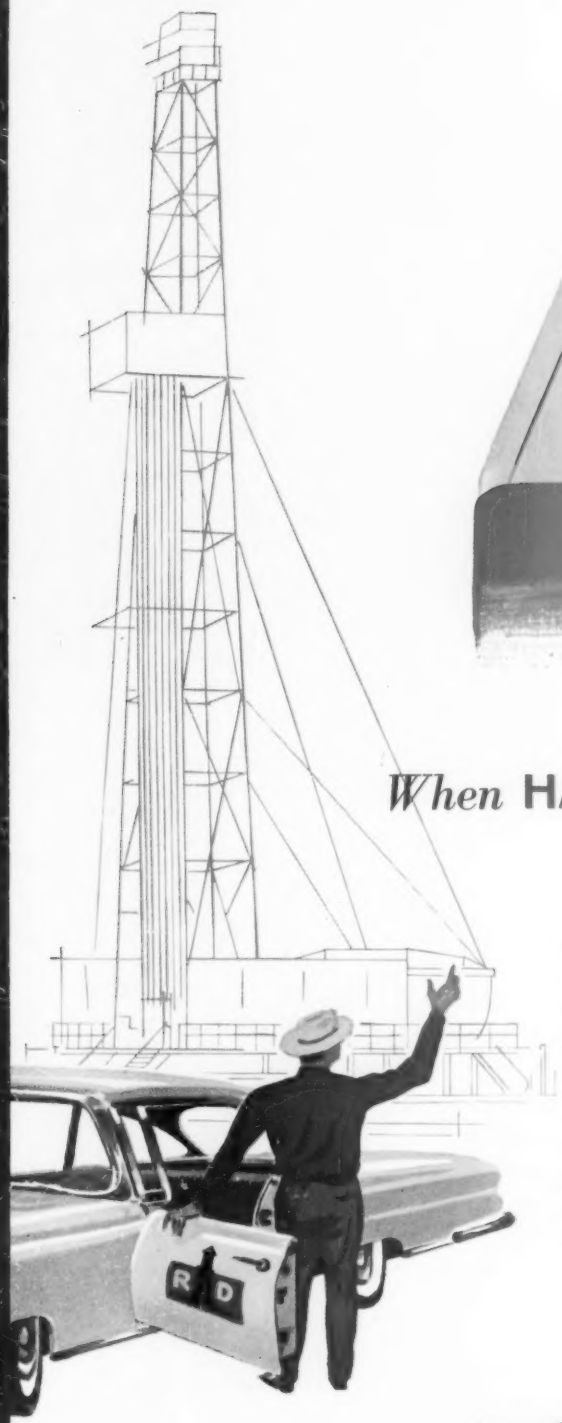
p. 43

How Mecom plans to drill to 26,000 ft. ▸ 47

Nationalism hampers Libyan oil development ▸ 61

1960 saw real advances in pipe laying ▸ 74

Arkoma: Bright promise for good headlines ▸ 123



When **HALLIBURTON** *Leaves the well...*

Over 35 years of oil well cementing service convinces this customer the job was done just as he ordered it. He has confidence in the men who performed the job because they went about their work as only men with Halliburton's unequaled experience and training can do.

The next time this customer has a well to cement, the odds are that he again will ask Halliburton to do it.

Halliburton is proud of this customer confidence and will always devote its energies to training the finest personnel . . . incorporating the latest developments and field proven techniques to provide the very best in oil field cementing services.

Halliburton COMPANY . DUNCAN, OKLAHOMA

OIL AND GAS JOURNAL
Vol. 59, No. 1

Contents January 2, 1961

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TECHNOLOGY—OPERATION

Drilling-Production

How to Correct Bed-Thickness Data From Directional Wells **68**

By B. V. Savoy and A. L. Valentine

Electric logs from directionally drilled wells do not show the true thickness of the pay zones. Corrections must be made before isopach maps can be used for reserve evaluation. Here are some methods that you can use on your crooked-hole fields.

Oil-Well Pumping—28 ..... **81**

By Joseph Zaba

How to combat gas lock in pumping.

Reservoir Engineering—31 ..... **92**

By E. T. Guerrero and F. M. Stewart

How to find reservoir-oil properties from laboratory fluid-analysis data.

Utah Well Clicks with 60% Oil-Emulsion Mud **100**

By J. N. Smith

Light weight and good flow properties of high-emulsion fluids can save money in lost-circulation areas. And rate of penetration is good. Modern emulsifiers can maintain an emulsion even when oil concentrations run well over 50%.

Pipelining

1960 Saw Some Real Advances in Pipe Laying **74**

By Paul Reed

Efforts to get more daily footage from pipeline spreads have been pushed in two directions during the past year. Two different techniques are progressing, each with possibilities of increasing spread output by about 30% under favorable conditions: (1) For small-diameter pipe, a two-pipe-gang method has been demonstrating its value; (2) for large-diameter pipe, double jointing has been increasing steadily with promise of greater use in 1961.

How to Get Better Lubrication **104**

By O. H. Moore

Modifications, better maintenance, close attention to lubricating conditions, and better-trained personnel are avenues which lead to better lubrication of equipment.

Refining-Processing

How Shell Will Clean Up Its Waste Water **72**

A biological generator will be added to the effluent-control system of the Houston refinery.

Itemized Quarterly Cost Indexes **73**

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Principles of combustion. Part 2.

Maintenance Planning Saves for Ethyl **78**

By I. R. Schneider

Maintenance planning and scheduling at Ethyl's Baton Rouge plant resulted in savings of almost 20% of total maintenance costs during the first 2½ years' operation of the program.

Refinery Cost Indexes **80**

Process Costimating—86 ..... **86**

Refinery obsolescence costs are not excessive.

Corrosion Tests Speeded By Ultrasonics **88**

No shutdown is needed to take measurements. Material inside the pipe or vessel does not affect measurements as long as its density is not close to that of the pipe or vessel material.

the OIL AND GAS JOURNAL Newsletter

Tulsa, Okla.
Jan. 2, 1961

Business begins 1961 in low gear:

It probably will move even lower in the first half before a definite improvement sets in.

Factors favoring an end to the recession in the last half: Strength of end-product demand and continued high confidence of businessmen and consumers.

That's the consensus of 14 nationally-known economists taking part in the Economic Forum of the National Industrial Conference Board.

The oil industry may follow that pattern too (p. 43)*.

At the start, oil prospects for 1961 look like this:

—Demand, up 2 or 3%.

—Production, up even slightly more than demand, especially if industry builds up crude inventory used in 1960.

—Prices, stable, even rising on heels of 5% wage hike.

—Drilling, wildcats up 10 to 12%, development off some, with an over all 1% increase. This could improve even more in last half if operators' income moves up as expected.

—Foreign, demand up 8 to 10%.

—Politics—uneasiness in oil circles in Washington over early Kennedy appointments touching oil. But shape of oil policies to come still has not taken form, and the industry may be better prepared in the capitol to tell its story than ever before.

▼ ▼ ▼

Imports will be cut back only slightly in the first half under the new rules. The reduction is 19,260 bbl. daily, far below what producer groups had hoped (p. 54).

The White House-approved rule change permits adjustment of quotas when a Bureau of Mines estimate for a previous period proves too high or too low.

Look for producer groups to fight for deeper reductions.

Cost of current oil wage hikes may exceed $200 million. The pattern apparently is being established at 14 cents

*Refers to article in this issue giving more details. When no page is given, the item is a Newsletter exclusive.

an hour more for some union groups or 5% for other groups.

With 292,000 workers employed in oil production and 117,000 in refineries, the 14-cent an hour raise for these workers alone will average about $120 million a year.

When raises are added for supervisory personnel, general office workers, marketing staffs, and executives the cost will move past the $200-million mark.

Latest to make the wage increase are Humble, Skelly, and Pure, Humble's offer was 14 cents per hour for hourly-paid workers and 5% for other salaried employes.

▼ ▼ ▼

Drilling engineers note: Details of the program planned to take a Mecom well in South Louisiana to 26,000 ft. have been revealed. If the well reaches goal, it'll be the world's deepest.

Estimated cost: $1,750,000 with another $250,000 needed if the well is completed (p. 47).

The rumor mill: On the West Coast there's talk that Union may have the same kind of corporate ownership as Richfield, now owned primarily by Sinclair and Cities Service.

Prospective Union owners are Gulf, which holds a big slug of convertible Union stock debentures, and Phillips, which owns 15% of Union's common stock. First hurdle before any such arrangement could evolve is the antitrust suit filed to keep Phillips from gaining control of Union.

▼ ▼ ▼

A decision is expected from FPC soon determining if pipelines will receive a "fair field" price for gas they produce themselves or if production will be figured by the same cost utility method as other operations.

Washington consensus in the case involving Panhandle Eastern favors a ruling for a fair field price.

FPC Chairman Jerome K. Kuykendall is pleased with gas industry cooperation in approaching regulation under the area-pricing policy announced in September.

Kuykendall says the general attitude among industry segments, which have been at loggerheads in the recent past, is to give it a chance to work, even though they disagree with some aspects.

▼ ▼ ▼

Declining railroad freight rates for king-size tank cars will spur a growing trend toward cars of 20,000-gal. capacity or bigger during 1961.

Prediction: The trickle of such rate concessions will become a steady flow in 1961 now that the economic benefits of graduated freight rates for larger shipments have been proved out. That's belief of Henry V. Bootes, president of the shippers, car line division of ACF Industries.

Sub-zero temperatures in the Midwest are booming gas sales. The Peoples Gas system had a record high sendout of 2 billion 126 million cubic feet in a 24-hour period December 23. Average temperature for the day: 6 below zero.

Of the total sendout, 1 billion, 620 million cubic feet came from long-distance pipelines and 506 million from underground storage facilities.

A $2-million chemical pipeline will be built across the Delaware River by SunOlin Chemical Co.

Plans call for 10 lines of 8-in. diameter running from SunOlin's $20-million ethylene plant now under construction at Claymont to a point north of Penns Grove, N. Y. Both projects will be completed by late 1961.

Ethylene and other chemical liquids and gases will be carried in the pipeline network.

▼ ▼ ▼

Trend worth watching: Use of more salaried employes at company service stations rather than lease operations. At least one company is testing the idea extensively thinking it may be the answer to high dealer turnover. Big question: Will it increase business?

Merger of the National Fuel Oil Council and the Oil Heat Institute is expected to be completed by April 1, if not earlier.

This will create the industry's first unified group to push oil heating. A top man—someone of the stature of a marketing vice president—will be sought to head the enlarged organization.

State highway users paid $173,000,000 more in motor-fuel taxes last year. Total tax was $3,427,000,000 compared with $3,254,000,000 in 1959.

State highway use tax revenue from all sources reached $5,352,000,000 during the year, a gain of 5%.

▼ ▼ ▼

Several possible petrochemical investments abroad are under investigation by Texaco. But company officials say they aren't ready to announce a move yet.

Texaco is getting out of the asphalt business in northeastern part of the U. S. It is closing two asphalt plants at Providence, R. I., and Claymont, Del. They were termed uneconomic under present marketing conditions.

Interesting result of Saudi Arabia's bloodless palace revolution is emergence of Abdullah Tariki as top man in oil with cabinet rank.

Tariki ironically had been close to the deposed Crown Prince Faisal. His promotion by the new ruler gives him added stature in world oil dealings (p. 64).

Market Memo

Jan. 2, 1961

The weather is still the whiskered man in a red suit for oil marketers.

They benefit twice from cold temperatures: Sales of kerosine and distillates become heavy. This makes clean storage available for excess gasoline produced in the off season. Refiners are not forced into dumping.

Result: A firmer tone to prices of both heating oil and gasoline. And generally that's what is happening now. The industry at the start of a new year is in much better shape on both inventories and prices than a year ago.

On the East Coast heating oil is moving out of storage into trade channels. Prices are still subject to discounting of from 0.2 to 0.4 cent per gallon in the Northeast, especially at Boston and Providence.

But with the Gulf Coast market firm at 8.5 cents, discounts in the Northeast may be expected to fade. Distillate prices generally are in good shape following increases posted 2 weeks ago. New York harbor barge prices are firm for No. 2 at 9.65 cents posted or 9.4 net; and for kerosine at 10.65 posted and 10.4 net.

Gasoline prices are better than a year ago, although spotty. Weak spots are Boston, Providence, Buffalo, Charlotte, Raleigh, and Charleston. Prices are firm in New York City, Baltimore, Philadelphia, and Norfolk.

On the Gulf Coast, inter-refinery buying of No. 2 fuel cropped up in the last 10 days of December. Three cargoes were reported sold at the posted price of 8.5 cents. No spot buying interest has been shown in kerosine, posted at 9.25 cents. Gasoline on the Gulf is unchanged at 11.25 cents.

A quick look at other markets:

Chicago—92-RON gasoline is being discounted one-fourth to one-half cent off posted 12.625 cents. Discounts of one-quarter cent also are made on No. 1, posted at 10.5 cents, and No. 2, posted at 9.75 cents.

Mid-Continent—generally firm at posted levels: 91-RON gasoline at 12.5 cents; No. 1 at 10.5 ; and No. 2 at 9.5. Discounting is disappearing as refiners strive to hold the price line in order to meet increased labor costs.

Mississippi River—market inactive with no spot sales reported. No. 1 and No. 2 offered at 9.5 and 8.75 cents to up-river buyers by refiners in the Arkansas City-Memphis area. Rumored discounts of gasoline at one-half cent off Gulf Coast postings go unconfirmed for lack of buyers.

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MISSISSIPPI—Natchez
NEW MEXICO—Farmington, Lovington
OKLAHOMA—Duncan, Oklahoma City, Pauls Valley, Sapulpa, Tulsa
TEXAS—Amarillo, Borger, Colorado City, Dallas, Houston, Midland, Odessa, Pampa

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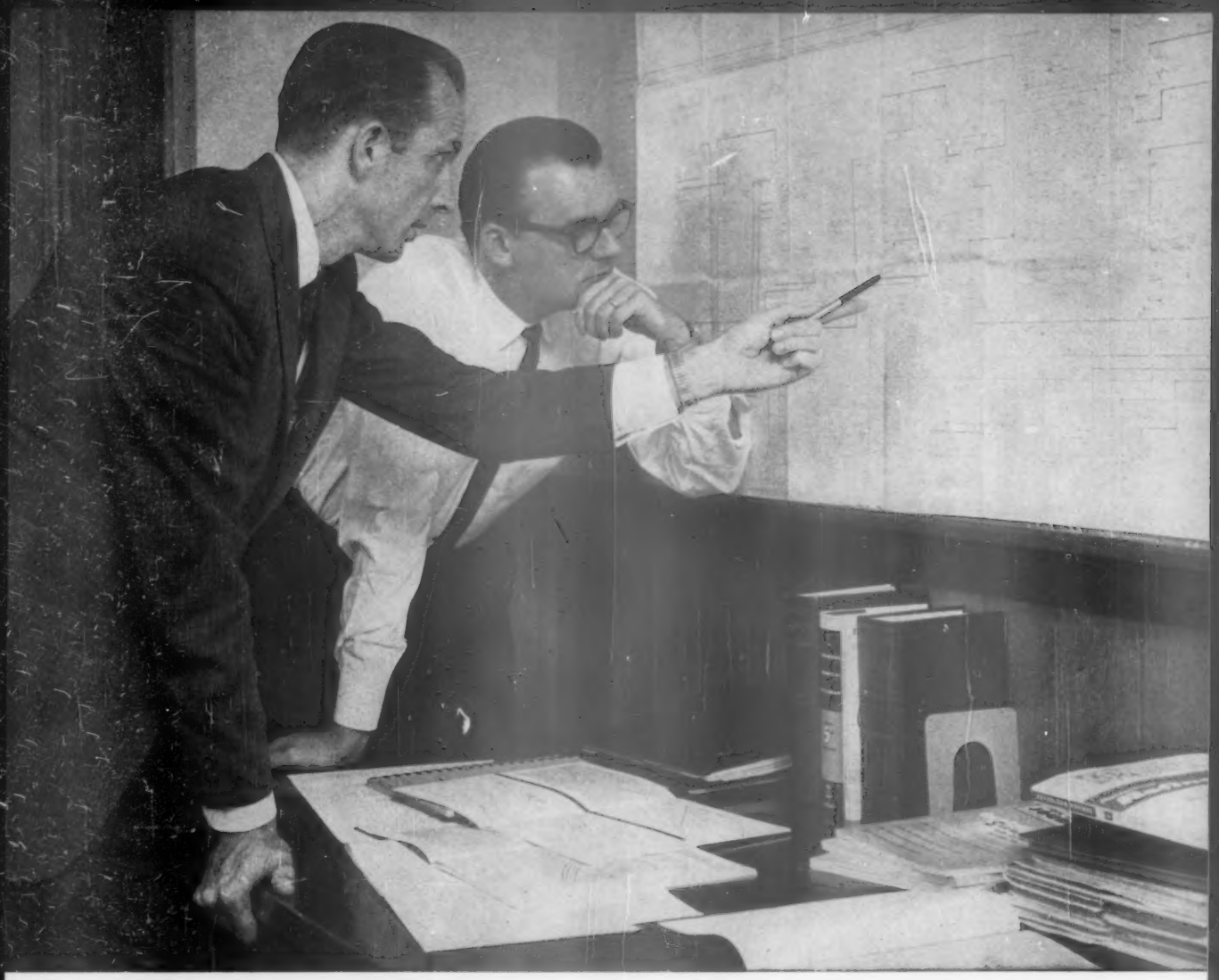

Jefferson Gas Processing Specialist helps pick the right chemicals

You may be in the initial planning stages of gas processing facilities. Or, you may be altering an existing dehydration or gas sweetening unit. In either event, selection of the right chemicals is most important. Here, Jefferson's Gas Processing Specialist can help.

He will thoroughly review your proposed processes and expected operating conditions with your engineers. In the removal of water by either glycol absorption or injection, the type unit, nature of the gas stream, degree of dew point depression and hydrate inhibition as well as the properties of the glycols are important in determining the *right* glycol . . . ethylene, diethylene and triethylene glycols or HI-DRY® tetraethylene glycol. Similarly in gas sweetening, the type and composition of the gas stream to be treated and final purity of product are important factors in the proper choice between monoethanolamine and diethanolamine sweetening.

Jefferson's Gas Processing Specialist can also suggest the most economical handling and storage practices for your operation, the best shipping means, and, of course, supply all your glycols and amines in the quantity and purity you need . . . Jefferson Chemical Company, Inc., 1121 Walker Avenue, P. O. Box 303, Houston 1, Texas.

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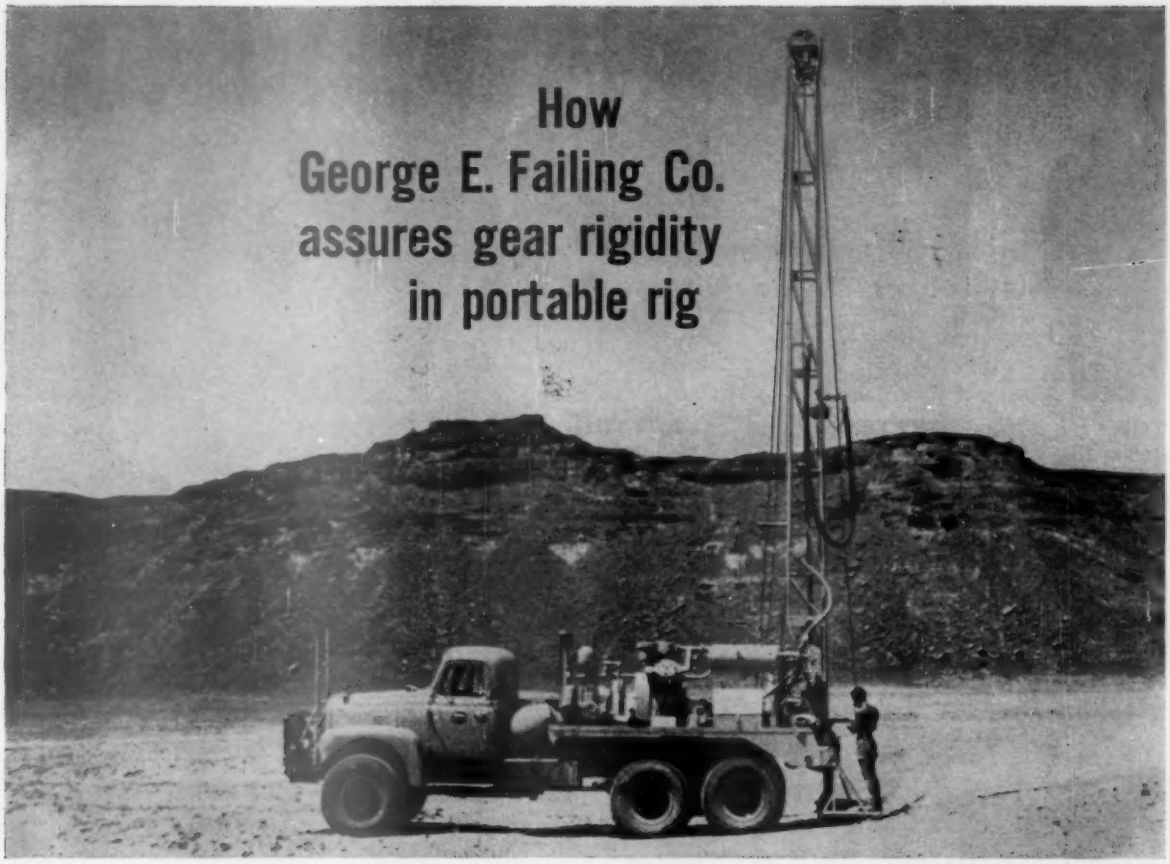

To be sure of trouble-free performance for their CFD-1B Holemaster® portable rig, Failing's engineers wanted maximum rigidity for bevel gear drives in both the draw works and rotary table. To get it, they specified Timken® tapered roller bearings. And they also specified Timken bearings for the water swivel.

Timken bearings hold gears rigid because their full-line contact of rollers offer minimum deflection and their tapered design lets them take radial and thrust loads in any combination. They permit exact bearing setting to give optimum performance. What's more, the mounting of Timken bearings on the bevel gears permits accurate gear mesh setting with no disassembly of the drive.

ENGINEERING SERVICE that often solves bearing problems on the spot is the kind you get from our graduate engineer salesmen. They'll help you select the right and most economical Timken bearing for your products.

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tapered roller bearings

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BETTER drilling rates in all types of muds: T-8, lime, gyp, and low pH, with varying amounts of oil.

BETTER (lower) barite requirements when substituted for oil in muds.

BETTER hole lubrication, in all types of muds, to reduce pipe sticking.

BETTER bit bearing life **even in high solids muds.**

BETTER geological interpretation and electrical logs; no fluorescence.

PLAN WITH BIT LUBE to drill 5 ways better . . .

MAGCOBAR PLANNED MUD PROGRAMS make the above statements facts, not claims. In high weight emulsion muds, for example, the Magcobar engineer properly substitutes Bit Lube® for some of the oil to cut drilling costs by reducing the amount of barite required. In a typical well, the oil content of the mud was allowed to drop from 11 to 5 per cent. Bit Lube was added to this 17.8 lb./gal. lime mud with these savings in barite:

	Sacks of barite per day	Cost of barite per day	Cost of Bit Lube per day	Cost of Oil per day	Total Cost per day
Emulsion (2 week average)	177	$409.76	$—0—	$74.03	$483.79
Bit Lube and Emulsion (3 week average)	52	120.38	122.43	8.25	251.06

NET DAILY SAVINGS WITH BIT LUBE: $232.73

Not only does Bit Lube give direct cost savings, but it also offers escape from costly pipe sticking, even in extreme directional holes. Bit Lube lowers the friction coefficient of the mud, to give over-all higher drilling mud performance. These savings can be added to those in the chart.

The skilled use of good products like Bit Lube to cut drilling costs is the heart of Magcobar Technology. Let the Magcobar engineer plan the mud program for your next well and this Technology will save for you all along the line.

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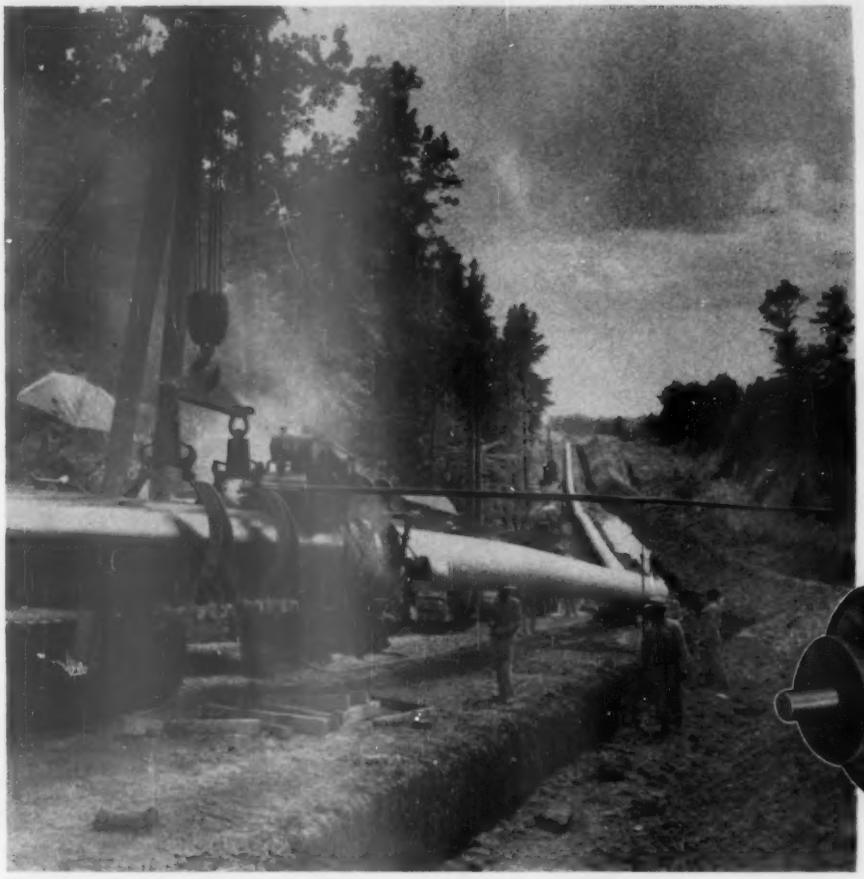

Crose Line Traveling Coating and Wrapping Machines manufactured by M. J. Crose Manufacturing Company, Inc., Tulsa, use crawler wheel covers (shown below) made of Hycar by F. H. Maloney Company, Houston, Texas. B.F.Goodrich Chemical Company supplies the Hycar nitrile rubber.

With Hycar to help carry the load, pipe wrapper works faster, smoother

This new pipe spraying and wrapping machine rides the pipeline on crawler wheels covered with Hycar nitrile rubber. In addition to providing the drive, these Hycar-covered wheels must bear the total weight of the machine, often as much as 3¾ tons. The Hycar covering assures positive traction without injuring the prime coat or indenting the pipe.

Like other kinds of rubber, Hycar gives the resilience for handling weights like this. Unlike other kinds of rubber, Hycar provides outstanding resistance to abrasion, temperature extremes, and oil and solvents present in coating materials.

Here's another reason Hycar is most often the choice for tough oil field operations. Next time you specify a rubber, it will pay in trouble-free, long-term performance to specify Hycar. For more information, write Dept. MF-1, B.F.Goodrich Chemical Company, 3135 Euclid Avenue, Cleveland 15, Ohio. In Canada: Kitchener, Ontario.

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3 heads are better than 1 . . .

Often a utility electric power company engineer enters into a decision with one or more oil company engineers . . . effecting the economy of operation. This assistance is available anytime to oil producers, pipeline personnel or refinery engineers. As a matter of interest the triple pumper in the photograph pumps simultaneously from three producing zones.

Petroleum Electric Power Association
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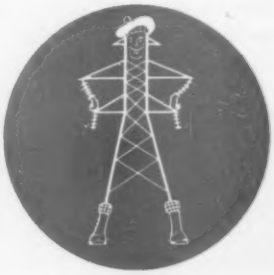
Utility Electric Power saves money, manpower, maintenance and serves you better automatically



A list of P.E.P.A. members will be furnished on request

"Sometimes I Think We Could Treat the Oil Just by Setting a Drum of Visco on the Lease"

Reports on Emulsion-Breaker Performance with Visco 485 ... A Typical Visco Formula

Visco 485 is one of dozens of emulsion-breaker formulas that Visco has developed for specific production areas and well conditions. It has taken off like a rocket—often producing dry oil to storage on leases where tank rolling was routine . . . and proving once again that "the tough jobs go to Visco"!

Here are a few instances where Visco 485 has solved difficult treating problems—one of which led to the optimistic statement in the headline.

Rough Gas-Cut Oil and Acid Water

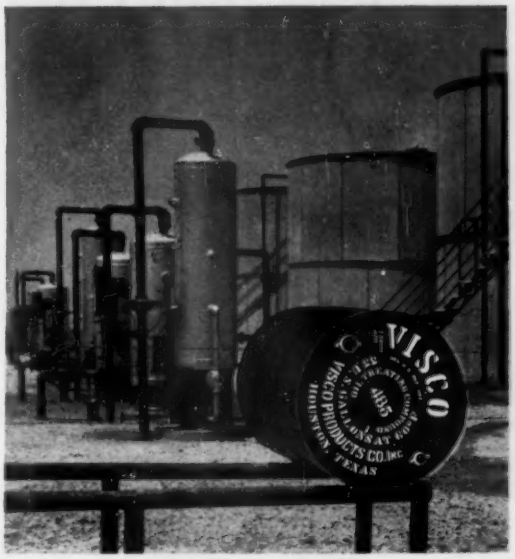
First 200-barrel tank from this new well had had 12 gallons of chemical and as much as 150° of heat . . . 1.0% water was still held up. Five gallons of Visco 485, and 30 minutes' rolling were all it took to sell the tank at 0.2% water.

Cut Chemical Feed 66%

Retreating was common on this lease. 80 to 90 barrels of oil per day took 1½ gallons of chemical. Test of Visco 485 produced 0.1 to 0.2% water in oil with only ½ gallon per day treatment. Results are uniformly good; superintendent plans to put Visco 485 on all remaining leases in the field.

Lowered Gas Heat Bill $300/Month

High tank bottoms, high heat, high treating costs—then Visco 485 and Visco 958 Paraffin Inhibitor were plant tested. Chemical consumption dropped from 10 quarts/500 bbls. to one quart 485 and 2 quarts 958. Tank bottoms disappeared. Heat was lowered from 125°F. to 70°F. for a $300/month gas bill saving. Lowered treating costs with Visco are capped with better oil quality.



Marvel Treater and 485 Cut B.S. & W. 20%

Oil from a new well was 19° gravity, pour point 51°F, 54% asphalt, 21% B.S. & W. Visco 485 was thoroughly dispersed in this heavy crude with a Marvel Treater. Result: 0.4% B.S. & W. Tests without the Marvel Treater could not bring B.S. & W. below 2.3%.

Visco sells or leases Marvel Treaters as an added Visco service to producers. Detailed data will be sent promptly on request.

Try Visco On a Tough One

Pick a well that is giving you emulsion-breaker troubles . . . high treating costs, tight emulsion, tank bottoms or heating problems. Let your Visco Field Service Man make a plant test for you. Odds favor him to come up with answers that can help you cut costs—and get dry oil, too. Call or write for Visco action today.

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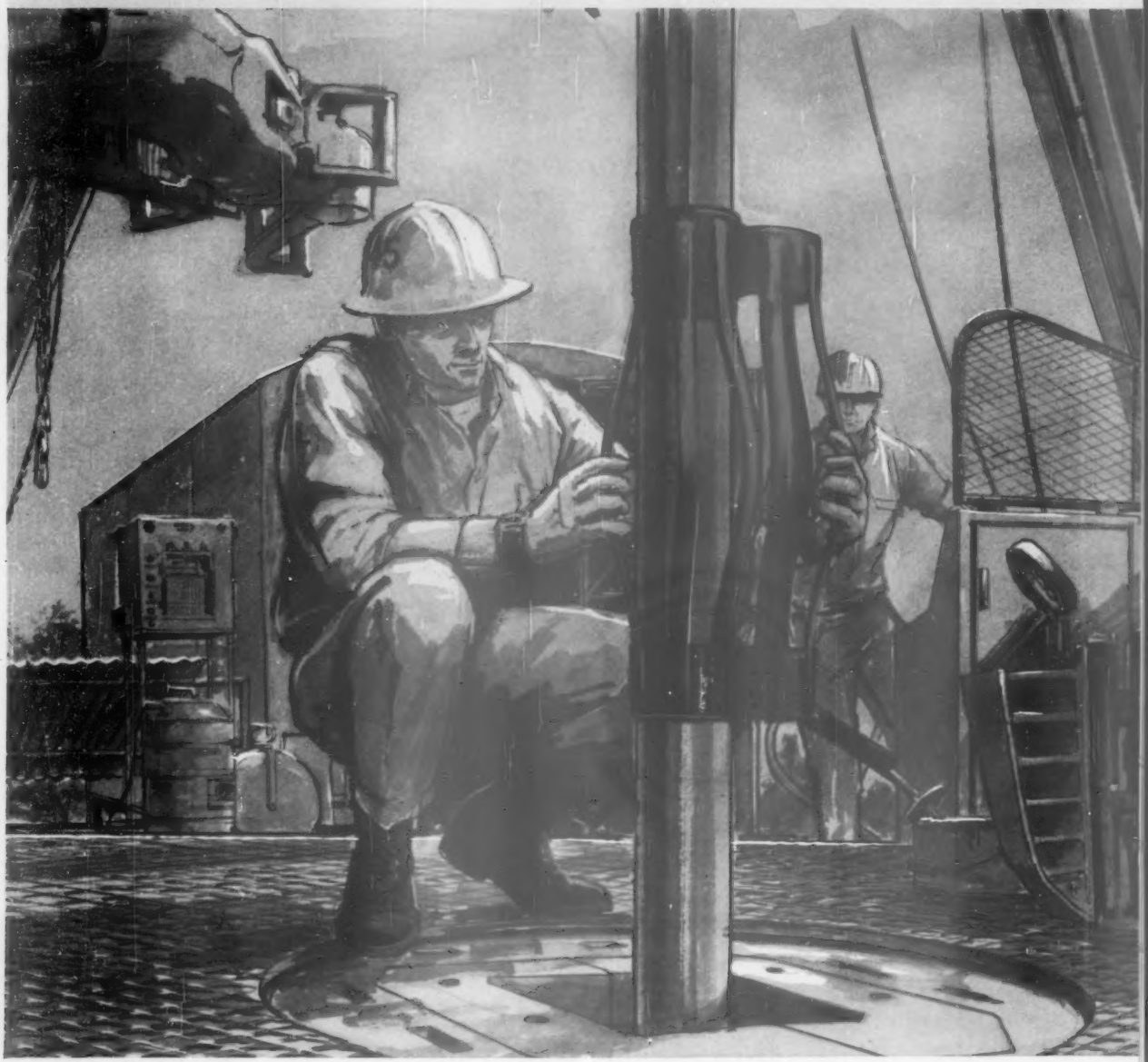
can centralizers be TOO EXPENSIVE?



Only when they are *wasted!* In many cases, excessive use of centralizers may make many of them ineffective. Placement of centralizers opposite over size washed out sections of the hole is a waste of money – *your* money.

how can you prevent this?

Let your Halliburton man help you plan for the *best* cementing job, including the right *location* – the right *spacing* – and the right *number* of Halliburton Centralizers to fit your individual well requirements.

You can base your Halliburton centralizer installation on a careful study of calliper logs – hole deviation data – core information . . . *not* just a "rule of thumb" formula of one per joint, or every other joint – or *any* set rule.

The value of this kind of pre-planning has been proven in our experience in performing over 2 million cementing jobs. Take advantage of this kind of experience on your next completion job . . . call Halliburton.

1.

2.

3.

4.

5.

5 good reasons to center casing

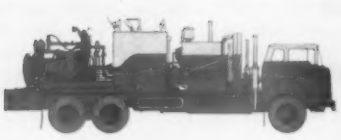
. . . and five good ways to do it!

- Provides a more uniform annulus around casing
- Allows more even distribution of cement around casing
- Helps prevent cement channeling
- Protects casing while rotating
- Helps provide for a better bond between casing and formation

1. **for regular casing HALLIBURTON S-3 CASING CENTRALIZER**
   . . . is available for all standard casing sizes. Sturdy heat treated, oil quenched springs provide maximum centering effect during entire trip to bottom. Hinged for easy installation.
2. **for regular tubing HALLIBURTON S-3 TUBING CENTRALIZER**
   . . . special modified design for all standard tubing sizes. Unique spring design provides good centering effect in wide ranges of hole sizes.
3. **for slim hole completions HALLIBURTON SLIM HOLE CENTRALIZER**
   . . . designed with non-flex springs to provide high centering accuracy in the limited annular confines in slim hole drilling.
4. **for tubingless completions HALLIBURTON RUBBER CENTRALIZERS FOR TUBING**
   . . . are designed with stout rubber ribs to provide excellent centering effect at the greater depths being completed today with tubing instead of casing.
5. **for multiple string completions HALLIBURTON TUBING SPACERS**
   . . . designed to center tubing strings in dual or multiple zone wells. Spacers are split for easy installation on tubing with metal banding.

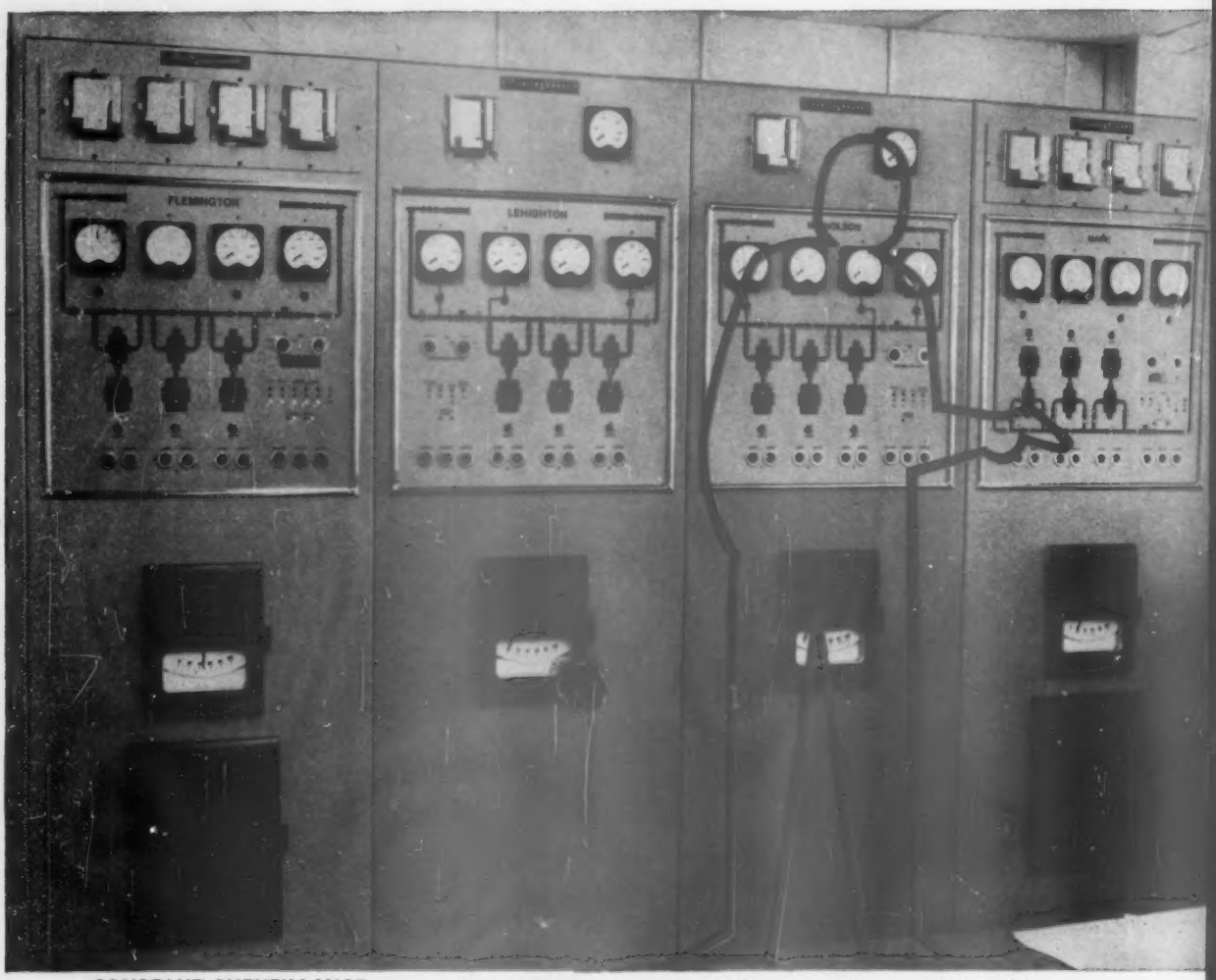
The *complete* story on how, when *and why* to use centralizers in your well completions is as near as your phone. Call your Halliburton man for full details.

275 Service Centers . . . just minutes away from your well

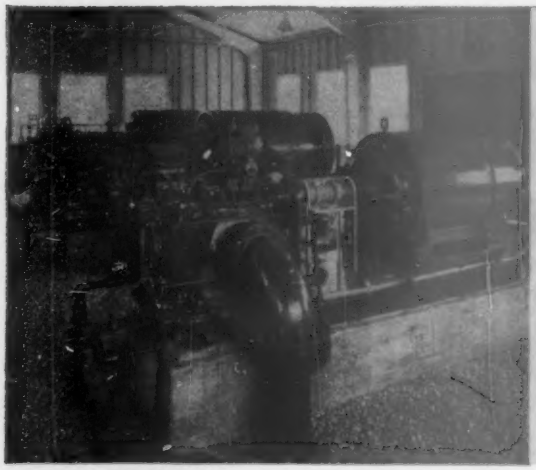


CEMENTING SERVICES

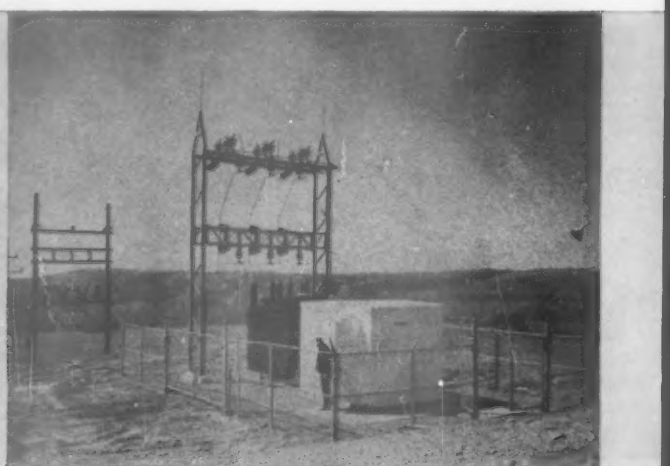
Halliburton
COMPANY • DUNCAN OKLAHOMA



CONSTANT SURVEILLANCE of operations at Buckeye's automated booster station is maintained by a Westinghouse control system. Indicator lights alert the dispatcher in Macungie, Pa., of any equipment trouble.



"NO MAJOR REPAIRS in 10 years." That's Buckeye's forecast for the huge, explosion-proof Westinghouse pump motors at the heart of Buckeye Pipe Line's new, remotely controlled booster station. Electrically powered stations like this Westinghouse-equipped installation at Maine, N.Y., are in sharp contrast to older, steam-operated stations needing 14 men around the clock.



"BEST POSSIBLE DESIGN" is Buckeye's opinion of 2000-kva Westinghouse transformer which steps incoming 34,400-volt power down to 2300 volts. Highly efficient operation was achieved after computer evaluated all possible design variables. Transformer's Insuldur® insulation system permits overloads with no reduction in service life.

WESTINGHOUSE AUTOMATES BUCKEYE PIPE LINE'S NEW 120,000-BARREL BOOSTER STATION FOR REMOTE CONTROL

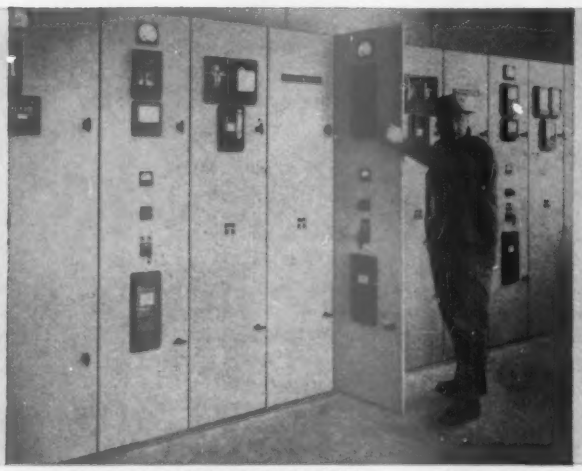
A dispatcher in Macungie, Pa., can completely control operations at Buckeye Pipe Line Company's new booster station 200 miles away, at Maine, N.Y. The Westinghouse-equipped station was built to step up Buckeye's capacity from 80,000 barrels per day to 120,000 barrels per day. The installation is the newest of five booster stations along a 14-inch pipeline that delivers refined oil products for 14 oil companies located from Linden, N.J., to Buffalo, N.Y. The Buckeye booster station at Maine represents the latest advances in pipeline automation.

"The station," reports the station foreman, "is seldom attended in person . . . and then by only one man. From the power transformer, switchgear and fault detection system to the electric pump motors, Westinghouse equipment enables our Allentown dispatcher to control pumps at the station, and learn from remote recording instruments the operating conditions of any one of the three motors, as well as the emergency shutoff valves. Any emergency warning lights that flash in the station will also flash in Macungie so that the dispatcher always knows whether everything is in proper working order."

The three 2300-volt Westinghouse pump motors provide 500 hp, 600 hp and 700 hp for pumping gasoline and heating oil. Pump power is converted to 2300 volts from an incoming 34,400 volts by a 2000-kva, oil-filled, outdoor Westinghouse transformer. A smaller service transformer, rated 75 kva, supplies power for lighting and auxiliary equipment.

To aid pipeline operators in achieving more efficient, cost-saving distribution, Westinghouse offers a long-term, step-by-step plan leading to economical automatic operation. It is called *Progressive Automation*. For more facts about *Progressive Automation*—call your closest Westinghouse representative. Or write Westinghouse Electric Corporation, P.O. Box 868, Pittsburgh 30, Pennsylvania. *You can be sure . . . if it's Westinghouse.* J-96157

Westinghouse



RELIABLE CIRCUIT PROTECTION for station's electrical system is provided by Westinghouse metal-clad switchgear. Maintenance is facilitated by use of horizontal drawout-type DH magnetic air circuit breaker. Switchgear can be remotely or locally operated.

ADEQUATE POWER AND PROTECTION for supervisory controls, lighting and auxiliary station equipment are supplied by Westinghouse control center. Center is composed of interchangeable, space-saving, easily installed modular units.

with efficient, economical Davison Silica Gel

Hydrocarbon recovery from the dehydration of natural gas can pay your gas drying costs. The large pore volume of Davison Silica Gel attains recovery efficiencies up to 95%. For example, a unit operating on 30 to 120 minute cycles at 100° F. can recover up to three gallons of butane-plus per 100 lbs. of silica gel.

Specify Davison Silica Gel in your hydrocarbon recovery unit. Write Dept. 3111 for complete information.

Department 3111
W.R. GRACE & CO.
DAVISON CHEMICAL DIVISION
BALTIMORE 3, MARYLAND

CHOOSE FROM A COMPLETE LINE . . . Another reason why you get more value with Guiberson . . .

Sure, there's a difference!

Dress your swab with genuine Guiberson cups and see for yourself.

You wouldn't wear a tux in a ball game, or overalls at a formal dance — and, for successful swabbing, it's more important that your swab be correctly dressed to suit the conditions. Guiberson, and only Guiberson, offers a selection from nine types of cups and suitable swabs in sizes ranging from 1" through 13⅜".

In most tubing swab jobs, one of three types of well-proved, service-certified Guiberson cups will give superb performance.

Type J

Flexible, strongly reinforced for repeated runs under heavy loads in deep wells.

Type L

More flexible, for medium or heavy loads in wells of any depth.

Type GW

Even more flexible, for light to medium loads in shallow wells, stripping light loads in wells of any depth, and for use in rough or deformed pipe.

Swabbing in oil, water, or acid-water, these cups last and last and lift fluid at a rate that assures a profitable operation. It stands to reason that, with the many variables possible in swabbing, no single type of cup or swab can give maximum performance under all conditions. If you have a special problem, your Guiberson representative will gladly recommend the combination of cups and swab best suited for your particular situation. Supporting his selection is the experience and integrity of the first and foremost swab manufacturer in the world.

Sold by Oil Field Supply Stores Everywhere

THE GUIBERSON CORPORATION
DALLAS, TEXAS, U. S. A.

SAFE THAN SORRY BETTER BE GUIBERSON

DRESSER INDUSTRIES INC

PRODUCTION, DRILLING AND WORKOVER SPECIALTIES, MOLDED RUBBER PRODUCTS

OIL • GAS • ELECTRONICS CHEMICAL • INDUSTRIAL

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This Knight-at-Arms Licks Oil Problems!

This versatile oil man-engineer-banker who heads our oil department, helps our correspondents in many a head-on clash with oil problems. As the crest shows, he's from the "show-me" state, too, which is why he's good in his business! Remember, First of Tulsa has one of the oldest, most experienced oil departments in America . . . with one of the largest oil credit files — for **better** oil banking — just . . .

Think... 1st of Tulsa SINCE 1895

FIRST NATIONAL BANK AND TRUST COMPANY

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NOW! 3 grades of slush pump liners available at your "Oilwell" store!

DI-HARD **An Exclusive, Premium Quality Liner.** Gives outstanding performance under severe conditions. Extreme resistance to abrasion is provided by a wearing surface of patented DI-HARD metal, with its proven hardness and low coefficient of friction.

HI-HARD **A Long-Lasting, Hardened-Steel Liner.** Made of a special forging-quality steel with properties exactly right for successive heat-treatments, the HI-HARD Liner can be exchanged many times.

EXCHANGE **A Re-Worked, Economy-Priced Liner.** Carefully reconditioned. Its hardened wearing surface is of the same extra depth and high finish as provided in a new HI-HARD LINER.

All three liners are machined and honed to exacting specifications. Wearing surfaces are polished to a mirror-like finish.

When you buy "Oilwell" liners and other expendable parts, you get the benefit of many years' experience in design and manufacture of slush pumps. You also benefit from round-the-clock testing at "Oilwell's" fluid-end parts test center, where field conditions are simulated.

And—your nearby "Oilwell" store is a convenient place to get your liners, pistons, valves and seats—and everything you need in running supplies.

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USS **Oil Well Supply Division of United States Steel**

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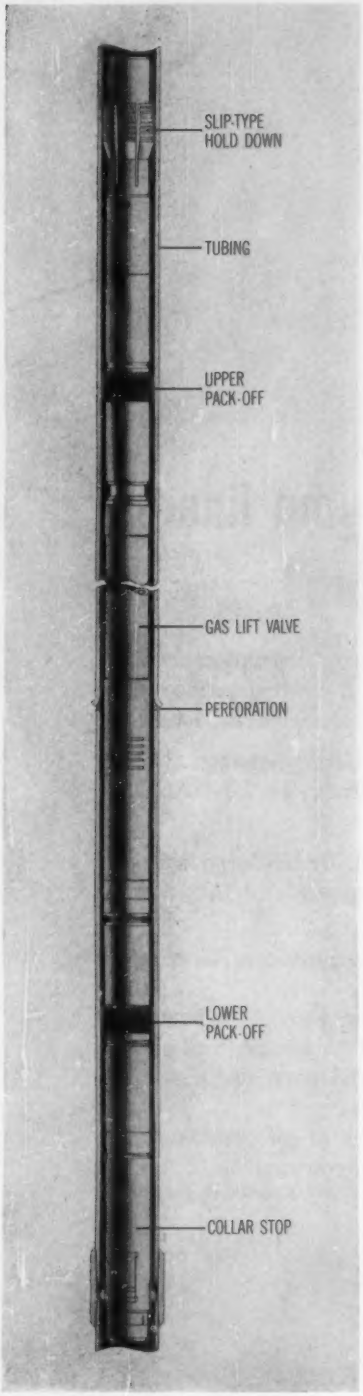
SPECIAL REPORT TO MANAGEMENT

OTIS PRODUCTION NEWS

Volume II, Number 3 **Otis Engineering Corporation • Dallas** *Production Equipment and Services*



Cost-Conscious Producing Companies Endorse Otis All Wire Line Technique Of Converting Wells to Gas Lift

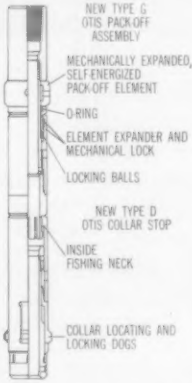
CORPUS CHRISTI—Eliminate the cost of a pulling unit to round-trip tubing when converting a well to gas lift and you can save an impressive amount of money per well. That's what several of the major producing companies in this area discovered when they started using the new Otis "All-Wire-Line" Gas Lift Conversion Technique.

A spokesman for one of these majors recently stated that his company is most enthusiastic about the technique — especially for water locations — because "(1) it's faster, (2) it's less expensive, (3) it's every bit as efficient as other types of installations they have made, and (4) it eliminates the risk of damage to the producing formation from contamination by mud and/or water in the annulus." Another company reported a savings of $60,000 in converting three, readily accessible, land locations.

As an example of how the technique can reduce the cost of a conversion, take a look at the following case history: A 6800-foot well located in approximately three feet of water in the Copano Bay Field ceased to flow naturally and was scheduled to be put on gas lift. In making plans to have the work done, it was discovered the approach canal had filled with silt and sand, which meant an expensive dredging operation would be necessary before a barge-mounted workover unit could be moved onto location; cost of a workover unit would be $1400 per day, and the annulus was loaded with old drilling fluid. Estimated conversion costs were mounting fast. A conference with the Otis Gas Lift Specialist in the area convinced the operator he should try a Type CG Otis Pack-Off Gas Lift Valve installation.

After setting a circulating plug in the tubing at the spot indicated for the lowermost valve, perforating and circulating mud from the annulus, it took the trained Otis Wire Line Specialist only 15½ hours of wire line time to perforate and install five concentric Type C Gas Lift Valves between Type G Otis Pack-Off Assemblies and have the well ready to be put back on production. Eight months following the conversion, the well was still making its allowable in an economical and efficient manner. And to attest to the reliability of the new Type G Otis Pack-Off Assemblies, the well was being produced from the lower-most valve.

Otis Gas Lift and Completion Specialists are interested in helping you find a way to complete and produce your wells in the most efficient manner. The experience these men have accrued throughout the years is yours to draw from when faced with any down well completion or production flow control problem. Use the knowledge these men have to offer and you will find you'll be spending your production dollars more efficiently. For more information on the Type CG Otis Pack-Off Gas Lift Valve, call the Otis office nearest you or write Otis, Dept. 3-W, Box 35206, Dallas 35, Texas. You'll find your Otis specialists ready to help you — anxious to serve you.


NEW TYPE G OTIS PACK-OFF ASSEMBLY
MECHANICALLY EXPANDED, SELF-ENERGIZED PACK-OFF ELEMENT
O-RING
ELEMENT EXPANDER AND MECHANICAL LOCK
LOCKING BALLS
NEW TYPE D OTIS COLLAR STOP
INSIDE FISHING NECK
COLLAR LOCATING AND LOCKING DOGS

Straight through, full opening bore of pack-offs, collar stop, and gas lift valve permits maximum production with minimum turbulence.

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Engineering OTIS Corporation

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Valuable blending services available to Du Pont tetraethyl lead customers

When the familiar yellow and green Du Pont tank car rolls onto one of your blending plant sidings, you're taking delivery of more than a shipment of tetraethyl lead—for the services that go with it can be as valuable to you as the antiknock compound is to the quality of your gasolines.

For example, if you're planning continuous in-line blending of gasoline components, Du Pont men are ready to help you with their experience. If you're planning a more modern blending plant, our operations group will be glad to assist your engineers in developing and perfecting its design.

In addition, special services are available for blending plant construction and operation, including, for example, site selection and the training and medical examination of blending plant personnel.

But comprehensive blending plant service is just one example of the many services available to Du Pont tetraethyl lead customers. Your Du Pont Petroleum Chemicals representative will be pleased to discuss them with you. For more information, contact him or write to E. I. du Pont de Nemours & Co. (Inc.), Petroleum Chemicals Division, Wilmington 98, Delaware.

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A Nalco PRODUCT MANAGER

Answers Questions About Refinery Equipment Fouling And Successful Anti-Fouling Programs

Both Organic and Inorganic Deposits in Refinery Equipment Raise Operating Costs, Decrease Throughput

Corrosion control, desalting, oxygen scavenging, gas blanketing and adjustment of process variables will help to reduce exchanger fouling—but in many systems, fouling continues to cause trouble. Here are some of the questions that are asked, and the answers we had to find to them in order to develop anti-fouling programs of real value to refineries.

Question: What causes fouling in refinery systems?

Answer: Inorganic salts, corrosion products and organic polymers. Inorganic salts are carried into exchanger trains by water dispersed in the hydrocarbon, and deposit out as the water is vaporized on heating. Corrosion products may be carried into exchangers from other units, or corrosion may occur in the exchangers themselves. Organic polymers are insoluble, polar, high-molecular-weight materials, formed as the hydrocarbon is heated.

Question: Where does fouling occur?

Answer: Fouling may occur in virtually any part of a refinery system; however, these are the areas where fouling is usually most troublesome: heat exchangers and furnaces ahead of catalytic and thermal cracking units, reforming units, and crude units, fractionating towers, reboilers and overhead condensers. Types and amounts of deposits vary, depending on the charge stock, corrosion control measures, and process variables.

Question: Why is an anti-fouling program necessary?

Answer: Because of the high cost of processing in fouled equipment, created by: reduced heat transfer; lowered throughput; downtime; and direct cleaning costs.

Question: How does Nalco solve fouling problems?

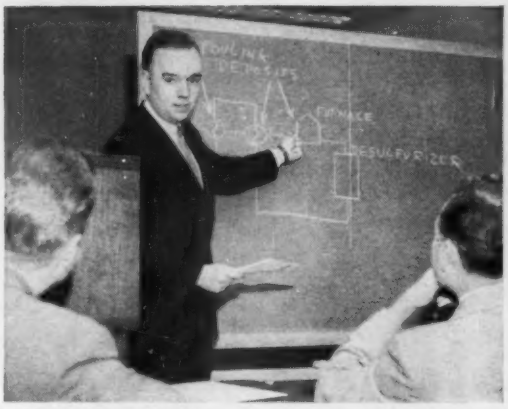
Answer: By making a careful analysis of the system, locating units where fouling occurs, and finding the sources of fouling. When these facts are available, recommendations are made for an anti-fouling program.

When the program is in operation, Nalco field representatives maintain close contact with operating personnel, cooperating to secure continuously successful, economical results.

Question: What is Nalco's anti-fouling program?

Answer: It is a program designed for a specific refinery system to eliminate corrosion, organic polymer formation, and any other sources of fouling. Where fouling is due to potential deposit-forming materials in charge stocks, Nalco-developed chemicals are recommended to stabilize and disperse these materials.

Usually anti-fouling additives are used in combination with Nalco corrosion control chemicals; and, where indicated, following Nalco desalting chemicals.



R. C. Canapary, Product Manager, Petroleum Industry Chemicals Department, Nalco, is a Doctor of Chemical Engineering, whose experience includes technical and engineering work at Nalco, as well as several years with a major oil company.

The assistance of Nalco representatives in regularly recording and evaluating the effects of temperatures, heat transfer rates, pressures, and other process variables helps to assure optimum results in operating efficiency and treatment economy.

Research and development work is a continuing part of the Nalco anti-fouling program. Nalco researchers use specially-designed equipment to simulate plant operations. Conditions can be established to accelerate fouling rates and speed development of promising new chemicals.

Question: How long does it take to establish the Nalco anti-fouling program?

Answer: A Nalco anti-fouling program can begin promptly at your request. Nalco considers a program established when anti-fouling and corrosion control results are proven satisfactory.

The electrical resistance method of corrosion evaluation, corrosion coupons, iron-in-water tests, operating records (temperature, pressure, heat transfer coefficients) and direct inspections should be used to evaluate the program's effectiveness.

Suggestion: Get full details on a Nalco anti-fouling program for your operation. For quick action, call your Nalco Representative, or write to me at Nalco: Dr. R. C. Canapary, Product Manager, Petroleum Industry Chemicals Department.

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PRETTY CRUDE

There've been a lot of wells drilled that wouldn't even produce one jar of crude . . . maybe half the ocean, but not oil. On the other hand, when you do get a producer, that oil sure is pretty!

When you get to the point where you really want to know what's down there, the surest way to find out is with a Johnston Drill Stem Test. Cost? The average Drill Stem Test on an 8,000-ft. well runs about $400. Pretty inexpensive! Equipment? Fast, accurate and tough! One example is the Johnston packers which have breezed through hydrostatic pressures up to 23,000 psi and over 400° temperature with no sweat. We don't know the word "failure," either.

Whatever you've got — oil, gas, water — you'll know every time with a Johnston Drill Stem Test. Nothing crude about the way those Johnston testers operate — ever! They'll test any hole faster and better, and cut your costs, every time! Think about it! Then call us.

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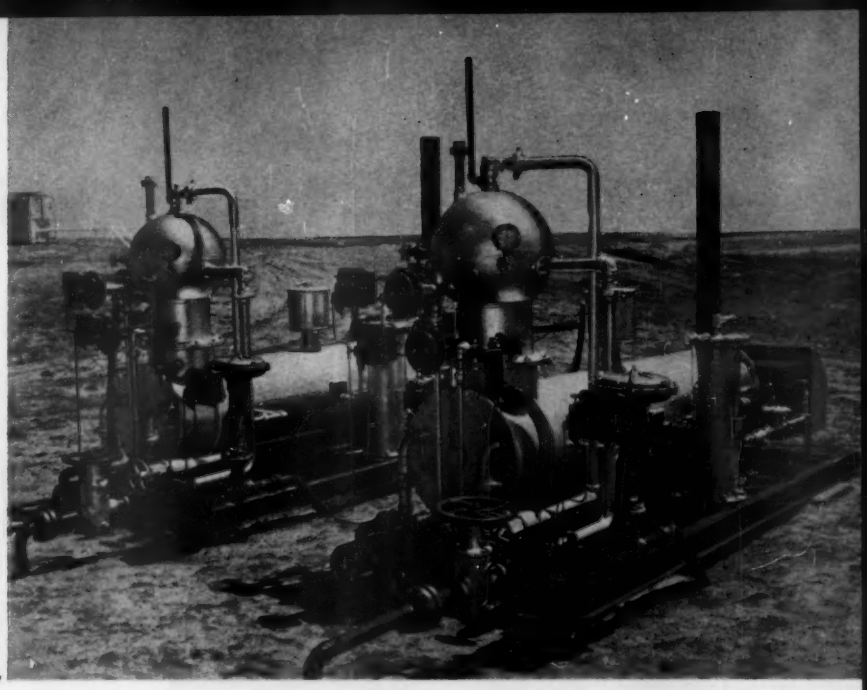
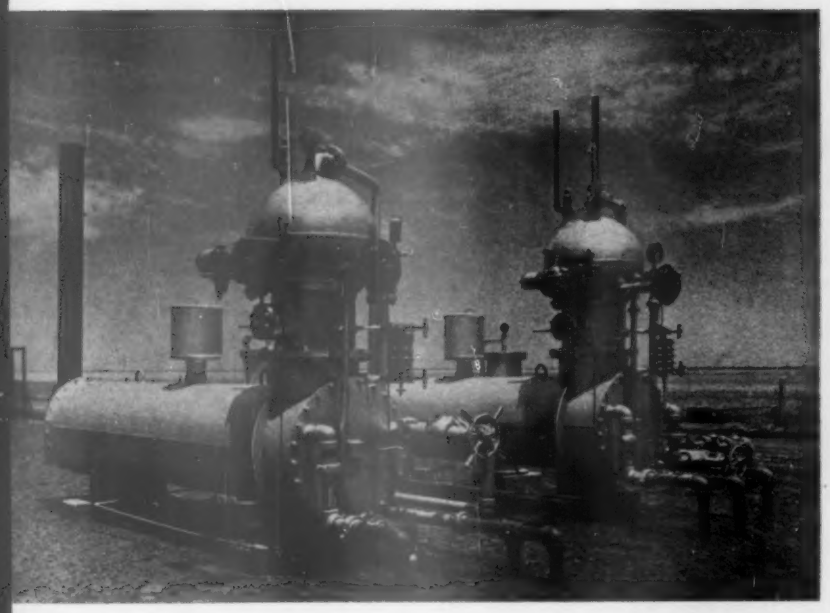
These two BS&B FREE-O-FREEZ Units are typical of many going into cold weather areas.



The Economy Package...

For Freedom From Freeze-Ups!



FREE-O-FREEZ by BS&B is a packaged Heater-Separator requiring minimum hookup and specifically designed for cold weather operation . . . gives dependable, trouble-free service . . . even in the dead of winter!

FREE-O-FREEZ is a neat, compact, integrated unit . . . combines the field-proved advantages of spherical separation and indirect heating to provide efficient water-oil separation and release of solution gas.

Prior to choking, the wellstream is heated in the heater flow coil to prevent freeze-up and hydrate formation. The water-oil separator section of the spherical separator is immersed in the water bath of the heater where it absorbs heat to prevent freeze-up. Flash arrestors are provided for safety.

FREE-O-FREEZ is available in a wide range of heater sizes, coil ratings and spherical separator sizes . . . and with a large selection of heater and separator accessories . . . to satisfy a variety of lease conditions. Simple, rugged and accurate controls are used.

A call to your BS&B Man will bring you detailed information on the unit best suited to your requirements. Or, you may write to . . .

BS&B

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NOW HIGH HEAT TRANSFER RATE with LOW PRESSURE DROP

Another Vogt Engineering Achievement

*One of the many distributor types developed for various applications.**

**Covered by Pat Nos. 2,057,597, 2,424,441 and others pending.*

TOP: *Muddy well water is the coolant for these Jacket Water Coolers.*

RIGHT: *Two 56" Dia. x 12'0" high Amine Solution Coolers with expansion joints in shell.*

BOTTOM: *One of a number of seawater cycle units for a chemical plant. Nylon distributing ferrules prevent adherence of barnacles. Low pressure drop allows circulation of large quantity of seawater.*

Special metering distributors control the flow in vertical Vogt film type exchangers of single tube-pass design. The liquid is spread in a uniform film over the inside surface of the tubes. Since the liquid falls by gravity, good velocity is obtained with a small quantity of liquid.

Vogt has developed many types of distributors which are made from a variety of materials to accommodate the fluids circulated through the tubes in specific processing operations.

A unique feature of these exchangers is that the tube side can be cleaned while in operation.

Vogt Film Type Exchangers are used as Coolers, Condensers, Absorbers, Heaters, and Evaporators.

Other Vogt Products

Forged Steel Valves and Fittings. Petroleum Refinery and Chemical Plant Equipment. Steam Generators. Heat Exchangers. Ice Making & Refrigerating Equipment.

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with

D+B *Two-Zone Pumps*

SIMPLICITY

means New Efficiency .. Top Economy

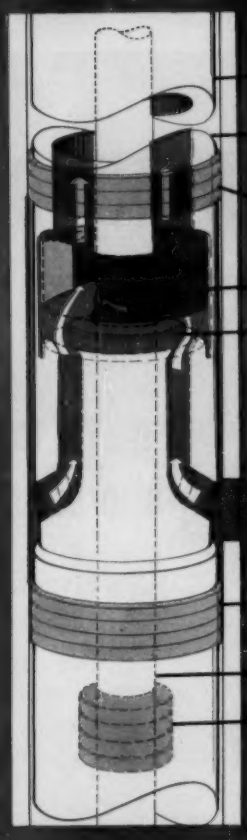
Because they're the simplest, D+B Two-Zone Pumps are the easiest to install, operate, adjust or repair. Result? Added economy and volumetric efficiency.

Working parts are all retrievable on the rod string; tubing stays downhole. You can change pump lengths on *any* model, even the two-packer pump with integral cross-over. Wireline-retrievable chokes add further flexibility and economy.

With the largest displacement of any two-zone pump, D+B extends the life of *all* your pumping equipment. You can shorten the stroke to reduce torque on the gear box . . or decrease strokes per minute to protect rods, unit pumper and prime mover . . D+B *still* delivers more fluid.

Continental's 78 strategically-located D+B Pump Shops slash your downtime with fast, efficient service . . anywhere. There's always a skilled D+B Specialist nearby to recommend pumps, supervise installation, analyze your problems and oversee repairs.

Get the full story on D+B Pumps for multizone applications. Ask your Continental-Emsco man, or write for Bulletin No. A-355.



EXCLUSIVE

Patented D+B Standing Valve Provides Matchless Flexibility and Volumetric Efficiency

This exclusive upper-pump standing valve eliminates hydraulic inefficiencies associated with "traveling standing valves." It offers the efficiency of a standard pump, plus all the flexibility required for multizone completions. Attached immediately below the upper pump barrel, it provides the closest possible spacing of standing and traveling valves for maximum compression. Its generous opening reduces gas "break out."

The simplified upper pump has only three special components: standing valve, pack-off and hold-down. Their extreme short length minimizes eccentric alignment of seals, reduces friction and eases installation in crooked holes.

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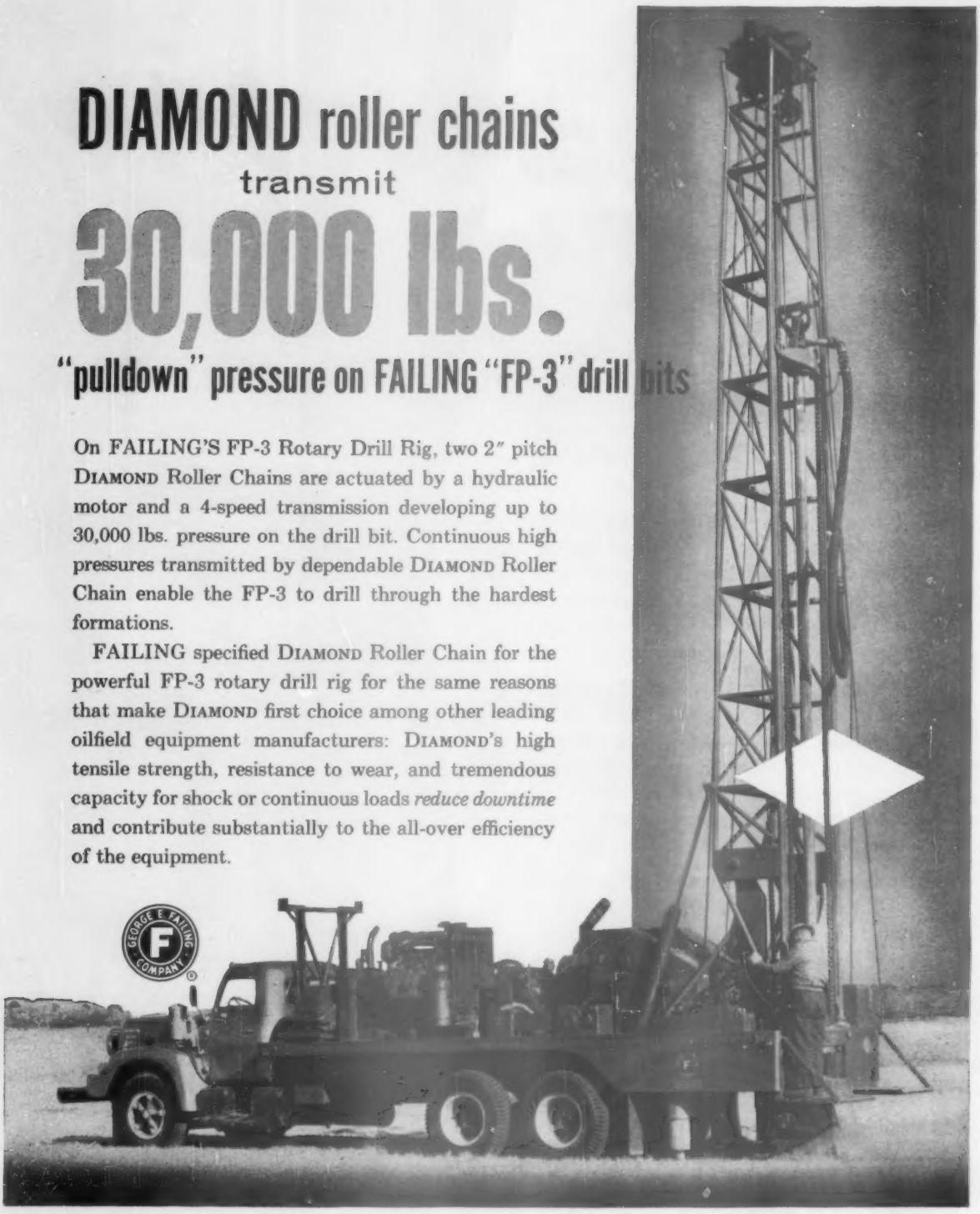
30,000 lbs.

"pulldown" pressure on FAILING "FP-3" drill bits

On FAILING'S FP-3 Rotary Drill Rig, two 2″ pitch DIAMOND Roller Chains are actuated by a hydraulic motor and a 4-speed transmission developing up to 30,000 lbs. pressure on the drill bit. Continuous high pressures transmitted by dependable DIAMOND Roller Chain enable the FP-3 to drill through the hardest formations.

FAILING specified DIAMOND Roller Chain for the powerful FP-3 rotary drill rig for the same reasons that make DIAMOND first choice among other leading oilfield equipment manufacturers: DIAMOND'S high tensile strength, resistance to wear, and tremendous capacity for shock or continuous loads *reduce downtime* and contribute substantially to the all-over efficiency of the equipment.



Complete stocks of DIAMOND Roller Chains are available from your oilfield store . . . or consult the Yellow Pages of your phone book for the name of your nearest DIAMOND Distributor.

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Engineering Progress Report

FROM UNION CARBIDE CHEMICALS COMPANY

REDUCE GAS-SWEETENING COSTS

Two simple control tests increase plant efficiencies

Chemical analysis is the only quick and efficient method of gauging the operating efficiencies of plants that use monoethanolamine to sweeten natural gas. By proper interpretation of the simple, yet accurate tests, plants can be operated more efficiently and at some cost saving.

Quick titrations can give this information and enable the plant operator to keep safely below solution overloading, thus minimizing corrosion and solution contamination.

TEST NO. 1—ACID GAS CONCENTRATION

The total acid gas content of both the rich and the regenerated lean solutions is determined by simple titration. By comparing the acid gas contents of these solutions, before and after regeneration, the regeneration efficiency and the net solution loading can be determined. This net solution loading (the amount of acid gas removed by the solution) should check with an acid gas material balance around the absorber.

An excess of acid gas in both the rich and lean solution indicates solution overloading or improper regeneration.

When the rich solution loading is high, while the lean solution loading is quite modest (here indicating good regeneration), one of three things may be at fault: (1) Insufficient scrubber fluid circulation; (2) Insufficient amine concentration; (3) either more gas is being processed than anticipated, or the acid gas content is higher than originally expected.

An excess of acid gas in the lean solution, when the rich solution is not overloaded, indicates improper regeneration or severe solution contamination.

STEAM REQUIREMENTS FOR REGENERATION

Enough stripping vapor should be provided to the regeneration column to remove essentially all the acid gas from the rich solution before it enters the reboiler. Normal steam rates vary between 0.8 and 1.2 pounds of steam per gallon of amine solution circulated.

FLUID CIRCULATION

In plants with all carbon steel equipment the amine solution circulation rate should be adequate to keep the net solution loading at or below 0.4 moles of total acid gas (CO_2+H_2S) per mole of monoethanolamine. Under these conditions, in the conventional plant, the rich solution will contain less than 0.5 moles of total acid gas per mole of amine; and the lean solution will contain 0.1 or less moles of total acid gas per mole of amine.

Contamination can be controlled by a side stream distillation unit that removes foreign materials and amine degradation products.

TEST NO. 2—MONOETHANOLAMINE CONCENTRATION

By titrating a sample of the lean solution with standard HCl, to a pH of 4.5, the per cent of monoethanolamine free for acid gas absorbtion can be determined. This information allows for proper control of amine concentration and, therefore, proper setting of the circulation rate.

OTHER TESTS

Union Carbide has for many years maintained laboratories for the examination of scrubber solutions, and for basic research in gas treating technology. These are two of many analytical tests described in the paper "An Approach to Monoethanolamine Solution Control: Chemical Analysis and Its Interpretation." This paper relates chemical analysis to plant operation and suggests remedial steps found effective in eliminating operational difficulties. For a copy, use the coupon provided.

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- ☐ Have a representative call.
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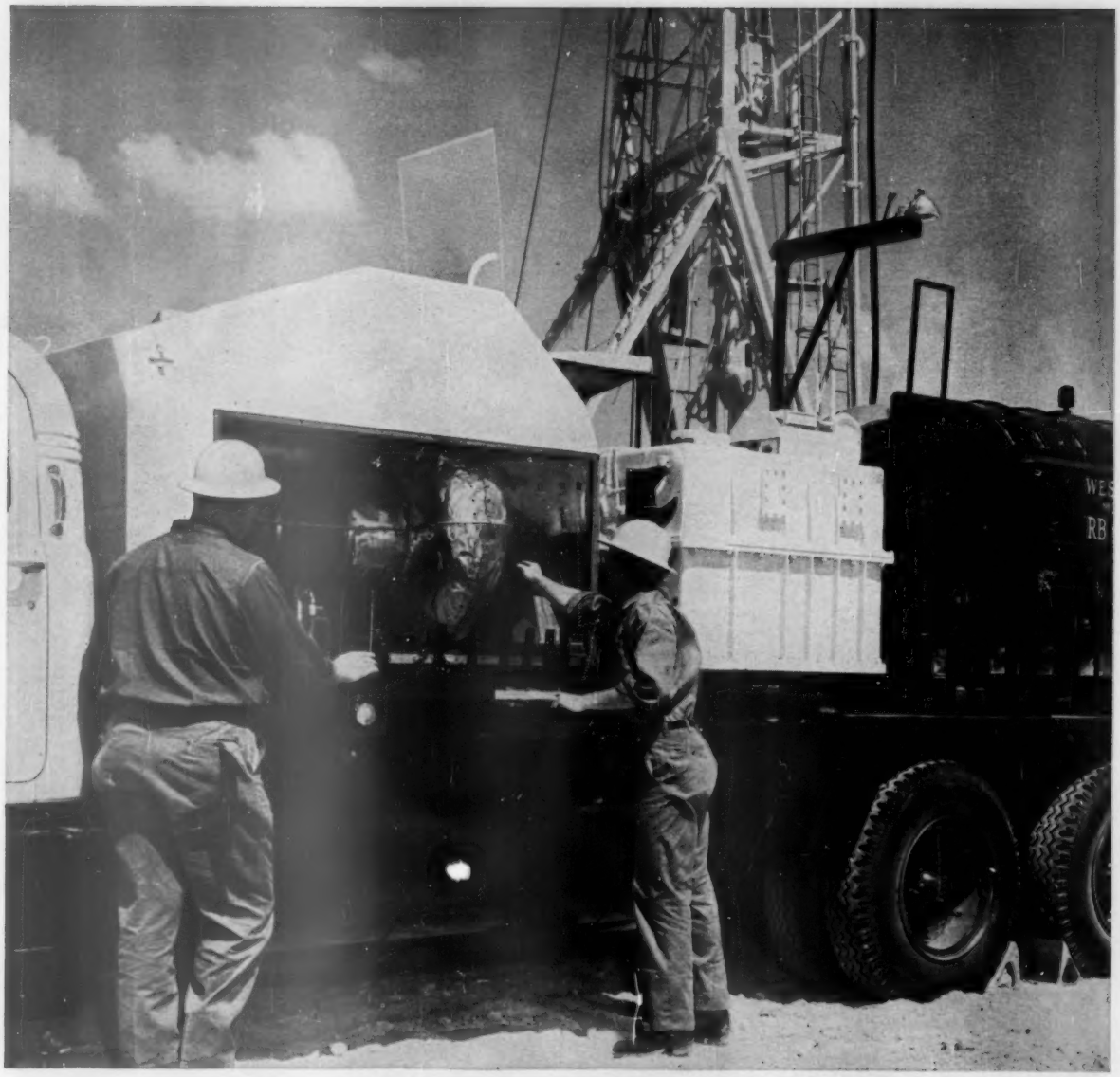

Solar gas turbine stimulates production of oil and gas wells

OIL FRACTURING OPERATIONS — used to stimulate production of oil and gas wells — must take place at the well site. This means that fracturing and acidizing pumping units must be lightweight and mobile — yet provide in excess of 1000 hydraulic horsepower for most operations.

The Western Company's new 1000 hydraulic horsepower fracturing pump is powered by Solar's *Saturn* T-1000 gas turbine engine. Up to 1250 hp is required to drive the pump in this application. Weight of the truck and turbine-driven fracturing unit is significantly less than 500 hp diesel units currently used by Western. The *Saturn* T-1000 turbine-powered pump delivers twice the hydraulic hp of the diesel units — reducing by 50% the number of units needed per operation.

The *Saturn* T-1000 engine weighs only 1200 lbs and occupies less than 51 cubic feet. It is simple in design, starts instantly from —65 degrees F to 130 degrees F, and takes full load in seconds without warmup. It has been engineered for simplicity of operation and long life under industrial conditions. As a compact and reliable power source for generators, compressors, pumps, and other oilfield equipment... investigate the *Saturn* T-1000 gas turbine. There's a Solar gas turbine for almost every application in the 50 to 1250 hp field. Write for particulars to Dept H-192, Solar Aircraft Company, San Diego, California.

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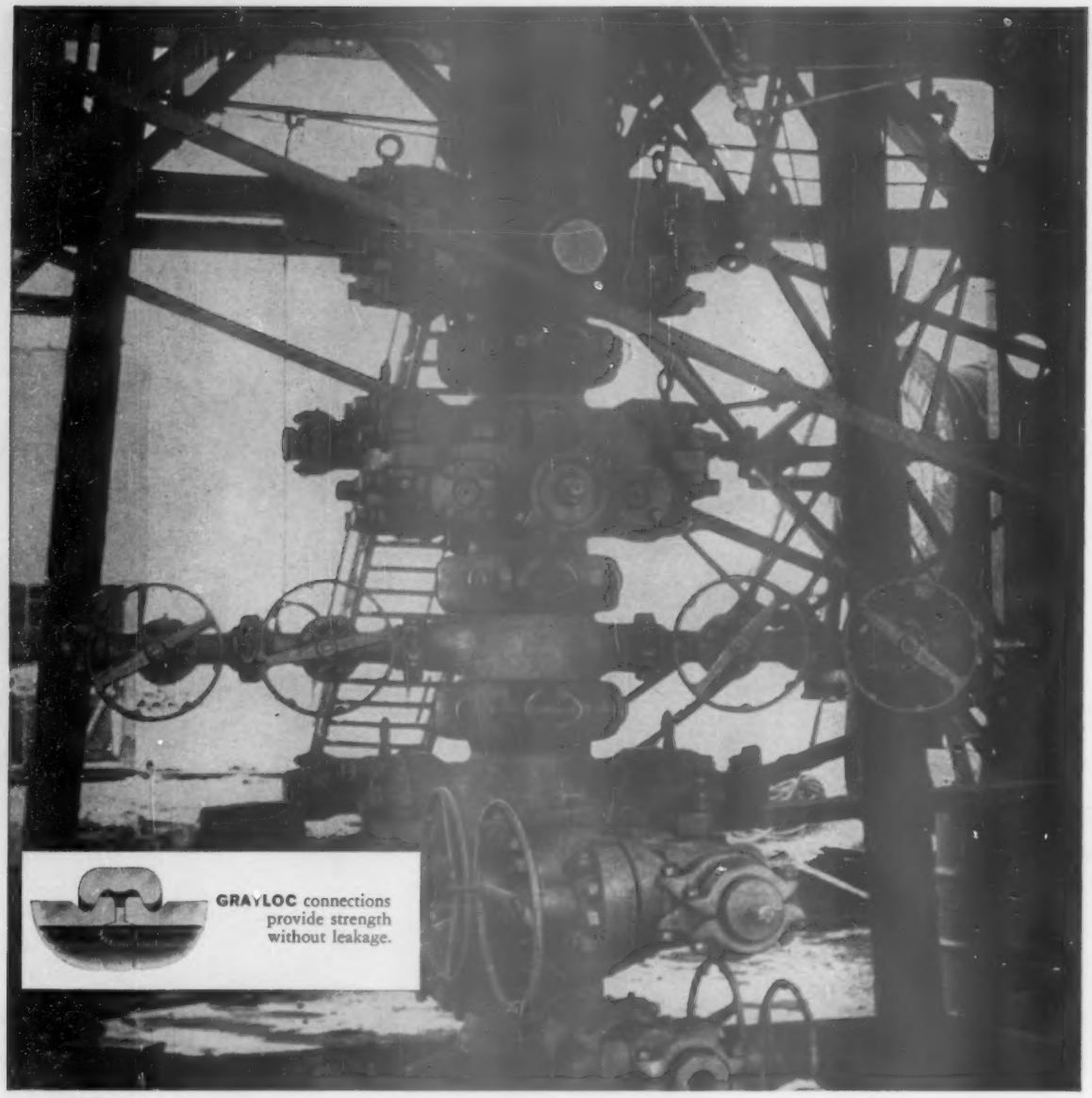

GRAYLOC on Well Head and Control Equipment Safely Withstood 7,300 PSI

This all Grayloc assembly, in use on a well in Eastern Venezuela, withstood well pressures of 7,300 psi during drilling operations — proving that Grayloc equipped assemblies provide the greatest possible blow-out protection. The assembly required no additional tightening after the original make-up.

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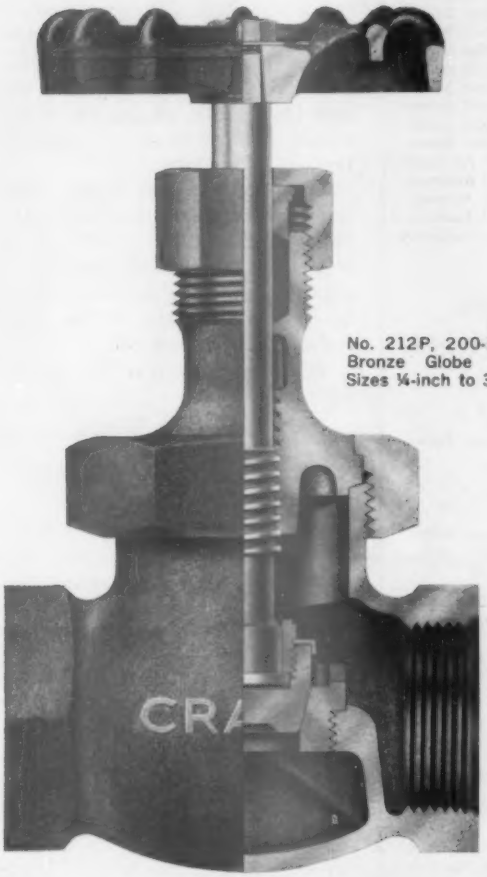

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They Say—

One of the finest

Dear Sir:

I have read with great interest your recent editorial "Key to Better Times: Market Awareness" (OGJ, Dec. 5, p. 69) and hasten to add that this is one of the finest editorials I have been privileged to read in a long time.

I am hopeful the results which have been obtained here in Kansas will spread to other states and eventually, if we all live long enough, to see the day when industry cooperation will be the usual rather than the unusual.

It is our plan to give this editorial wide circulation.

H. D. Moore
President
Derby Refining Co.
Wichita

Dear Sir:

We wish to compliment and thank you for the unsolicited editorial in the December 5 issue ("Key to Better Times: Market Awareness," p. 69).

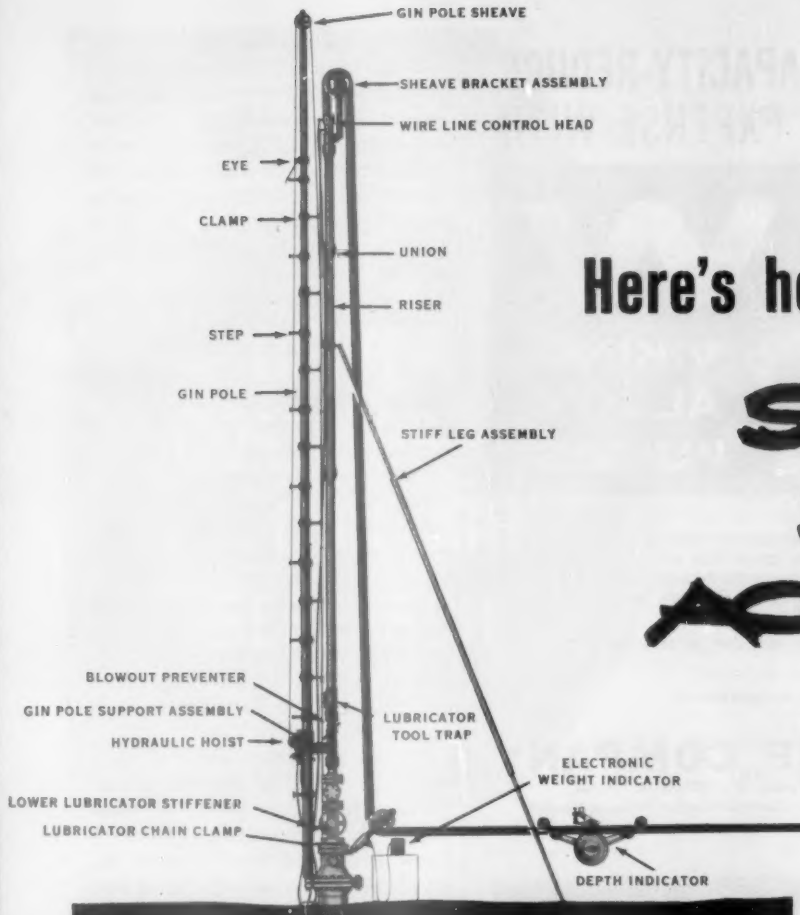
Tom L. Schwinn
Executive Vice President
Kansas Independent Oil and Gas Association
Wichita

Worth the price

Dear Sir:

Your November 28 issue contained an article entitled "Here's an Editorial Tour of the Deep Edwards Trend," (p. 112) by George R. Pinkley. To me, this article is worth the price of 5 years of subscriptions to the Journal, and I wish to congratulate you on this splendid piece of work.

I would also like to make a suggestion: I would very much like to see the location of the Lower Cretaceous fields on a base map of Texas with the counties outlined. I have looked at the United States Geological map and note that a lot of the production seems to follow, roughly, the surface contact between the Jackson and Claiborne group in



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the area Pinkley has written about.

I think one of the finest articles you could think of writing would be one in which you bring up to date the deep Lower Cretaceous wells drilled in the East Texas basin and the eastern part of the Gulf Coast in which you predict that either or both the Edwards and the Glenrose will be productive.

If memory serves me correctly, a paper in the AAPG Bulletin within the past year or so brought the East Texas basin up to date, so that only the area from where Pinckley's article left off to the Sabine River needs to be brought up to date.

A very interesting paper or article could also be written about the Woodbine sand pinchout that occurs between southeast Madison County and western Trinity County. Where will the ebb and flow of two saline waters, each probably varying greatly in salinity, cause the deposition of reefs in the throat or opening between the East Texas basin and the Texas Gulf Coast?

I think so much of the quality of the short article in your November 28 issue that I am writing to thank you for it. I would like for you to know first hand how much I enjoyed the "editorial tour," as it was so aptly named.

Carleton D. Speed, Jr.
Geologist-Oil Producer
Houston

Letters to They Say should be addressed to The Editor, The Oil and Gas Journal, Box 1260, Tulsa, Okla.

CALENDAR OF EVENTS

JANUARY

13 Southern Gas Association, research and development roundtable conference, Paso del Norte Hotel, El Paso, Tex.

15-16 Oklahoma Independent Petroleum Association, annual meeting, Mayo Hotel, Tulsa.

15-18 Pipe Line Contractors Association, annual meeting, Mark Hopkins and Fairmont Hotels, San Francisco.

16-19 Instrument Society of America, winter instrument-automation conference and exhibit, Sheraton-Jefferson Hotel and Kiel Auditorium, St. Louis.

17-19 Kentucky Petroleum Marketers Association, annual meeting and convention, Brown Hotel, Louisville.

18 Institution of Mechanical Engineers (Great Britain), symposium on pressure vessel research toward better design.

19-20 API Committee on Public Affairs,

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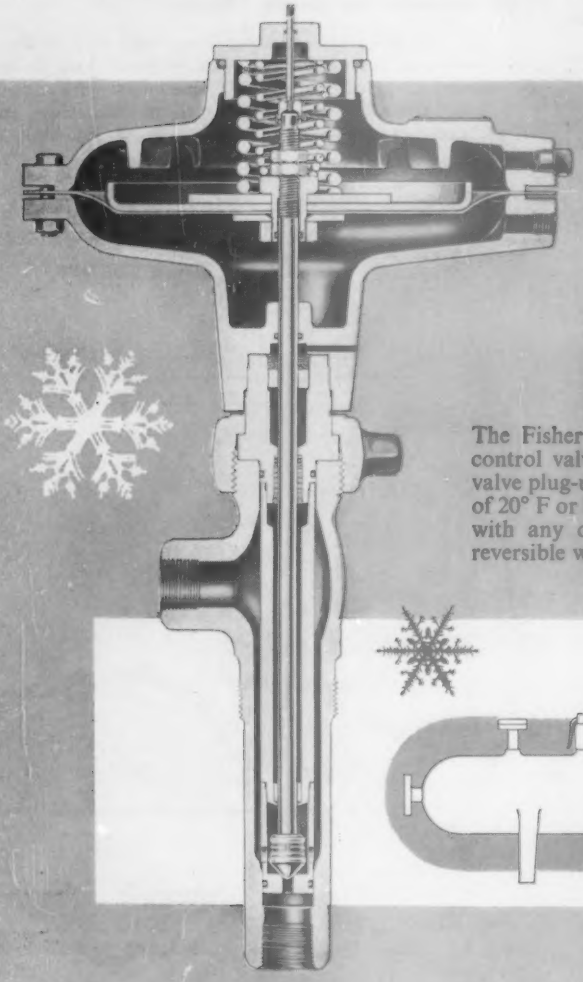

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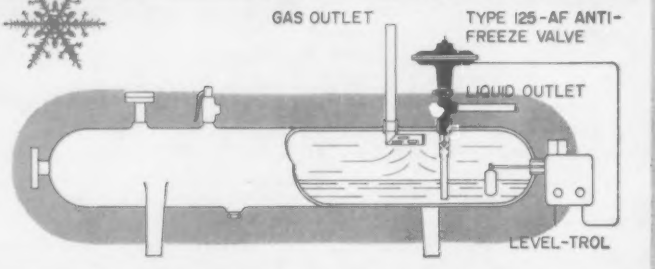

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20 Natural Gasoline Association of America, Gulf Coast regional meeting, Robert Driscoll Hotel, Corpus Christi, Tex.

20-21 Association of Oilwell Servicing Contractors, fifth annual convention, Dallas.

22-24 Kansas Oil Men's Association, annual convention, Broadview Hotel, Wichita.

24-27 Society of Plastics Engineers, seventeenth annual technical conference, Shoreham Hotel, Washington, D. C.

26-27 American Chemical Society, Southeastern Texas Section, fourth symposium on hydrocarbon chemistry, Shamrock Hilton Hotel, Houston.

30-Feb. 9 University of Illinois, annual quality control short course, Urbana, Ill.

FEBRUARY

7-8 University of Oklahoma, School of Petroleum Engineering, advanced petroleum engineer seminar, University of Oklahoma, Norman.

8-10 Southwestern Legal Foundation, twelfth annual institute on the law of oil, gas, and taxation, Southwestern Legal Center, Dallas.

9-10 API Committee on Public Affairs, New Orleans regional conference on employe communications, Roosevelt Hotel, New Orleans.

9-11 National Society of Professional Engineers, winter meeting, Hotel Fort Des Moines, Des Moines, Iowa.

14-15 National Association of Corrosion Engineers, Shreveport, La., section, short course, Centenary College, Shreveport.

15-16 Western Petroleum Refiners Association, Gulf Coast regional technical-industrial relations meeting, Rice Hotel, Houston.

16 API Committee on Public Affairs, Dallas regional conference on employe communications, Sheraton-Dallas Hotel, Dallas.

18 Purdue University, business history conference, "Management Decisions Under Government Regulation," Memorial Union, Purdue University, Lafayette, Ind.

20-Mar. 11 Advanced Drilling Practices Course for Engineers, University of Oklahoma, Norman.

24 Natural Gasoline Association of America, South Louisiana regional meeting, Lafayette Petroleum Club, Lafayette, La.

26-Mar. 1 American Institute of Chemical Engineers, petrochemical and refining exposition, Municipal Auditorium, New Orleans.

26-Mar. 2 American Institute of Mining, Metallurgical, and Petroleum Engineers, annual meeting, Chase and Park Plaza Hotels, St. Louis.

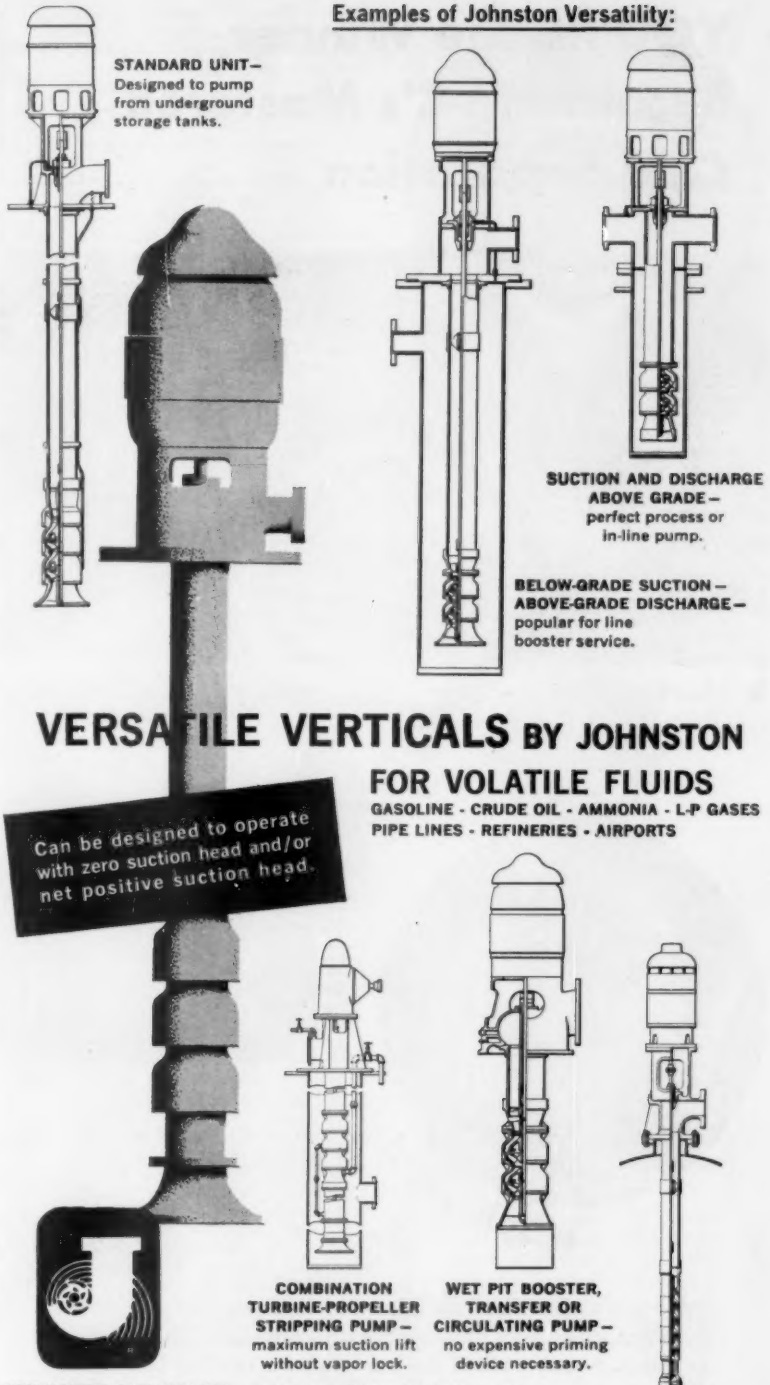
28-Mar. 1 API Committee on Public Affairs, New York regional conference on employe communications, Park-Sheraton Hotel, New York City.

MARCH

3 Ohio Oil and Gas Association, winter meeting, Deshler Hilton Hotel, Columbus.

5-9 American Society of Mechanical Engineers, gas-turbine power division, and U. S. Department of Defense, annual gas-turbine conference and products show, Shoreham Hotel, Washington.

7-8 University of Oklahoma, School of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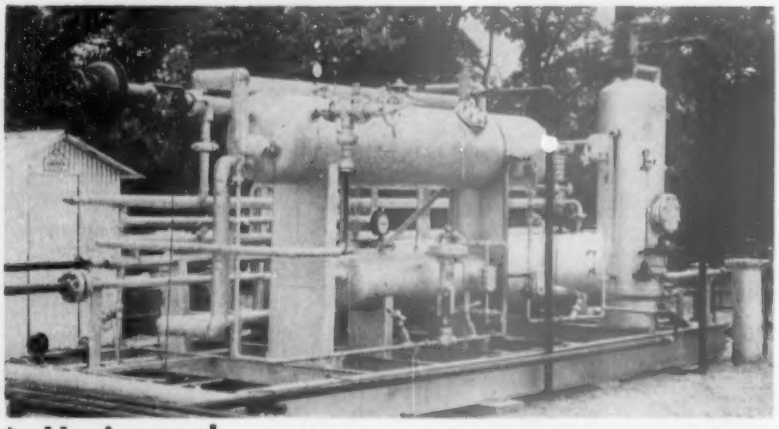

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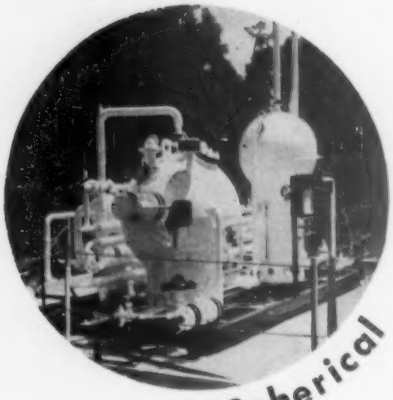

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Your gas dollars can be increased because Maloney Crawford has combined its engineering know-how and long experience to solve all of the complexities of cold separation. M-C can furnish you with a cold separation system you can depend on, in any size or shape . . . horizontal, vertical or spherical. With any M-C unit you are assured of the highest distillate recovery and contract dry gas, plus unmatched reliability. If you need cold separation M-C engineers have the answer. Contact them!

MALONEY-CRAWFORD
TANK & MANUFACTURING CO.
P. O. BOX 659 TULSA, OKLA.

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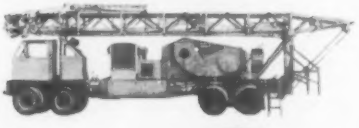
If you're caught in the cost squeeze

Get the facts about WINCHMOBILE JR.



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Before you buy get the facts on light weight... low cost... long life Winchmobile Junior with the cross mounted engine which saves moving parts and increases hp to the drum by 15%!

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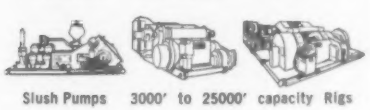

Slush Pumps 3000' to 25000' capacity Rigs

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8-11	American Petroleum Institute, Division of Refining, midyear meeting, Rice Hotel, Houston.
9-11	Western Joint Computer Conference and Exhibit, Ambassador Hotel, Los Angeles.
10-12	American Society of Mechanical Engineers, production engineering conference, Royal York Hotel, Toronto.
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16-19	American Petroleum Institute, Division of Marketing, midyear meeting, Americana Hotel, Miami Beach.
17-19	Western Petroleum Refiners Association, Mid-Continent regional technical-industrial relations meeting, Hotel Lassen, Wichita.
19	Natural Gasoline Association of America, Permian Basin regional meeting, Lincoln Hotel, Odessa, Tex.

Let R-u-b-b-e-r Take The Wear in your sucker rod pumps

• MARTIN RUBBER & DUCK RINGS give excellent life in dirty abrasive fluids . . . high or low gravity . . . much or little water . . . shallow or deep wells. They last for years in the easier pumping wells. Replacement rings cost comparatively little.

• MARTIN PLUNGER BODIES, precision grooved, drilled and threaded (no underneath fluid passage), usually last for years. Tube or barrel costs are often cut in half.

• The replaceable SYNTHETIC RUBBER GUIDES in MARTIN CAGES last longer than any metal, and the cushioning of the ball increases your ball & seat life. Results are often truly amazing. (Patent No. 2,591,174)

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JOHN N. MARTIN Manufacturer

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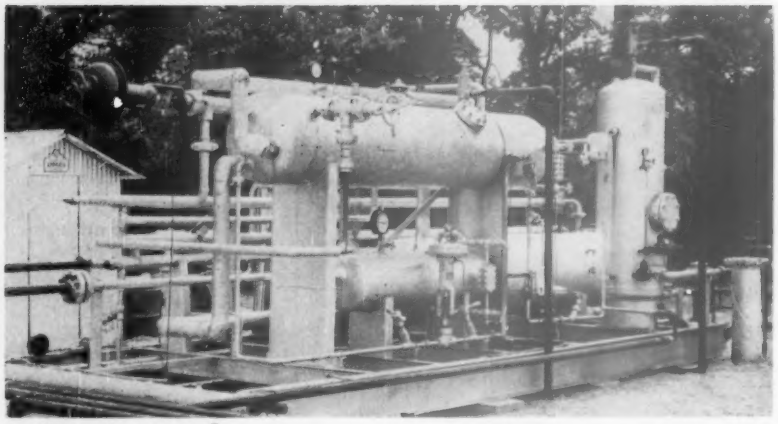

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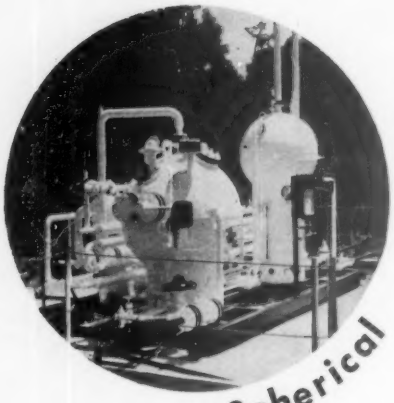

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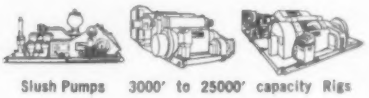

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JOHN N. MARTIN
Manufacturer
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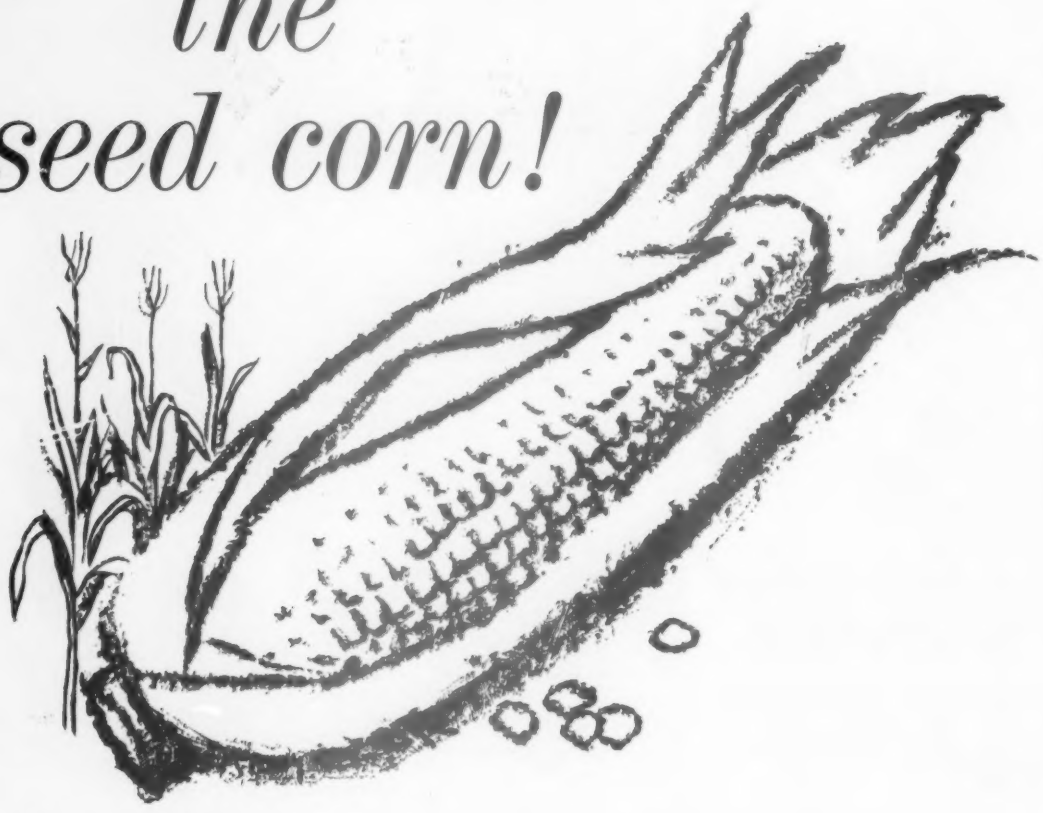
Number 1 of a Series

TELL THIS PETROLEUM INDUSTRY FACT TO YOUR NEIGHBOR

Don't eat the seed corn!



From each year's harvest, a portion must be set aside as seed corn to assure a crop next year. Never sold, never eaten, the seed is the only guarantee against a famine.

The same is true with oil and gas. A new "crop" must be *sought* each year. Percentage depletion, commonly but erroneously called "depletion allowance," provides the seed that finances the search and assures next year's crop of oil. A substantial portion of each year's income must be set aside by the petroleum industry, as seed, to guarantee a continuing supply of oil and gas. This operating principle has made the petroleum industry a leader in free world enterprise.

A nation deprives itself of its own future and penalizes all consumers when it deprives any industry of the seed that guarantees future productive harvests.

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BAROID

BAROID DIVISION NATIONAL LEAD COMPANY
MAIN OFFICE: P. O. BOX 1675, HOUSTON 1, TEXAS

BAROID—*Still Pioneering Drilling Mud Research • Engineering • Marketing*

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the Journal said...

50 years ago

January 5, 1911

The steamship Honolulan, the first exclusively fuel-oil-burning vessel to round Cape Horn, completes a notable 14,000-mile voyage from Baltimore to Seattle carrying a competitive cargo of 7,000 tons of coal. It consumed 14,000 bbl. of oil on the voyage. This represented 1 bbl. of oil moving 7,000 tons of coal per mile. Oil men puzzle over why oil would be used to transport coal 14,000 miles to an area where fuel oil is more plentiful.

Major oil purchasers post 2-cent increase in price of Oklahoma and Kansas crude from 42 to 44 cents per barrel. New schedule narrows differential with Illinois crude, quoted at 60 cents, to 16 cents.

25 years ago

January 2, 1936

New oil discovery by Herton Oil Co. in Charenton area opens first commercial production in South Louisiana's St. Mary Parish. Herton's well, 1 Roane, flows 25 bbl. of 41.6°-gravity oil per hour from sand at 7,460-7,512 ft.

Humble Oil & Refining Co., Humble Pipe Line Co., and Hanlon-Buchanan, Inc., join in unique $2,000,000 project to extract propane, butane, and natural gasoline in East Texas field, and deliver these products by pipeline to Humble's refinery at Baytown, near Houston, for processing to supply charging stock for a new polymerization unit.

Huge Conroe field, leading Texas Gulf Coast producing area, stands out on its fifth anniversary as model of cooperative scientific-development methods.

10 years ago

January 4, 1951

Newly formed Hugoton Plains Gas & Oil Co. purchases 95,000 acres of proved gas reserves in the Oklahoma Panhandle, and 20,000 adjoining acres in Kansas in deals totaling more than $36,000,000. Involved are 150 producing gas wells and gasoline plant at Hooker, Okla., handling 110 M.M.c.f. of gas daily.

Canadian Refiners will spend $75,000,000 in country's greatest refinery-construction program in history. Five new refineries projected along with other building and modernizing projects.

Five companies, including Gulf Oil Corp., Sun Oil Co., Sohio Petroleum Co., Pure Oil Co., and Cities Service Oil Co. join in plans for large new crude-oil pipeline from West Texas to the Gulf Coast. Gulf to operate proposed 26 and 24-in. system with capacity of 300,000 bbl. daily.

JOURNALLY SPEAKING

Bound to Please

NOW HEAR THIS, you clipper-and-filers, you page-tearer-outers. Notice anything different about this issue?

That's right—no staples. The book lies flat any place you open it. No deep gutter along the backbone. No hump in the middle of a spread.

We're using an entirely new type of binding. Strictly speaking, it's not really new. It's an old idea that never worked very well before because the right kind of glue wasn't available. But due to the advance of technology in the adhesives industry we can now get a kind of stickum that works just dandy.

So instead of tying the pages together with wire stitching, we just dab a little paste through slits in the edge. Ain't science wonderful?

If you are a tear-sheet collector—and most of our readers seem to be—you'll love this. Just try tearing out any page and see how easy it is, how clean it comes. No need to use a razor blade.

You do get a slightly ragged edge, and if this affronts your sense of the fastidious, just slip a ruler into the gutter and tear against it and you'll get a perfectly clean cut. Also, you have wide enough margins to punch for a ring binder.

If you're a librarian type you'll love it for a different reason—two reasons, in fact. You can bind a bunch of copies into book form without having to pry out those darned staples.

Furthermore, we now have no more perforated pages. In the past we perforated certain pages and sections for easy removal. This delighted the clippers but infuriated the librarians because after a certain amount of use these perforated pages would come out by themselves. Now every page is perforated and yet every page is permanently attached. Pretty good, eh?

And if you're just a common, garden variety of reader, you'll love this new binding too. The book lies flat and stays open. You don't have to pinch down against staples to read type in the gutter. You can even bend the magazine back on itself and read it on the bus with one hand—but we don't recommend it because that doesn't do any book any good.

So now the Big Yellow Book is bound to please everybody.

AND FOR THE BIFOCAL SET we're starting another innovation with this issue—bigger type.

Compare a page in this issue with any page in last week's. Notice the clean look of action, the great ease of handling, the feeling of speed and power in our 1961 model. Gives you greater visibility . . . relief from eyestrain . . . more lines per hour.

Detroit has nothing on us when it comes to turning out compacts with the big-car comfort and performance. We've got it.

You see, bigger type is easier to read, but it also means fewer words per page. And with so much going on in the oil and gas business, and with our readers demanding to know just all about everything, we were faced with the dilemma of pleasing those who want reading comfort without detracting from the full-detail deliverability of our product.

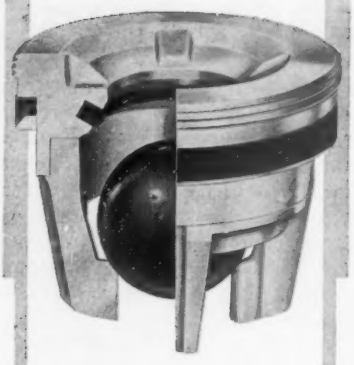
We finally solved the solution (as the fellow said) by compact writing. Our editors sharpened their blue pencils and found they could streamline any manuscript by tight writing and close editing—cutting out fancy phrases, repetitions, needless details.

By making every word work we can say more with fewer. You get the guts without the gilding.

A Journal page is now the compact with the impact. When better magazines are built, the Journal will build 'em.

—Henry D. Ralph

NEW FROM BAKER! TWO VALVES THAT INSERT IN CASING COUPLINGS



BAKER INSERT FLOAT CHECK VALVE

PRODUCT NO. 176

Replaces a conventional float collar in wells of moderate depth. It features the famous Baker "floating ball" that has successfully landed and cemented more strings of casing than any other type of back-pressure valve.

The Baker floating ball brings the ultimate in simplicity to the design. No springs, guides or hinges are needed.

Baker Insert Valves are constructed entirely of aluminum, plastic and rubber for ready drillability.

WRITE FOR BULLETIN 382

New folder gives facts of serious interest to the operator who is considering use of insert equipment. Address:

Baker Oil Tools, Inc.
P.O. Box 2274, Terminal Annex
Los Angeles 54, California

In wells of moderate depth, these new insert valves offer convenience and economy. They also offer many of the features that have made conventional Baker floating and fill-up equipment so dependable and so widely accepted.

IMPORTANCE OF THE VALVE-TO-CASING SEAL

A foot of concrete surrounds the valve in a conventional Baker collar. The insert valve must provide this valve-to-casing seal in a *one-inch* space—with varying casing weights and make-up.

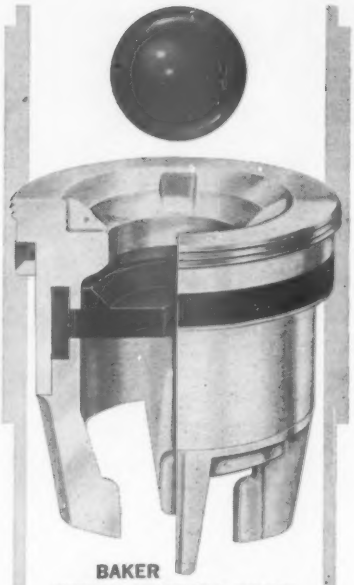
Seals so located that they rely on the pin above for back-up, tend to extrude and to leak—especially in lightweight casing. Baker's seal is backed by the metal of the valve itself. The underside of the seal is tapered and it is backed-up by a metal ring with matching taper. This combination of proper location and design enables it to seal-off against pressures from both above and below, in a wide range of casing weights, without interfering with joint make-up.

AUTOMATIC VARIABLE-ORIFICE CASING FILL

As described at right, the Baker Insert Flexifill Valve gives you genuine variable-orifice casing fill—for maximum convenience and protection from pressure surges. Why settle for less?

Your Baker Man will gladly explain the important differences in available Insert Equipment.

BAKER
OIL TOOLS, INC.
HOUSTON
LOS ANGELES
NEW YORK



BAKER INSERT FLEXIFILL VALVE

PRODUCT NO. 177

Incorporates the same ingenious automatic diaphragm found in the popular Baker Flexiflow fill-up collar. .

In running-in, as the pressure below the valve increases, the opening in the diaphragm becomes larger, and the casing fills faster. As the pressure decreases, the hole contracts and the casing fill slows. The result is automatic control of fill and maximum relief from pressure surges with no casing flow-over.

The advantages of a variable orifice are obvious when compared to a pre-selected fixed opening.

Circulation is carried out as desired. When on bottom, a ball is dropped down the casing and pumped through the diaphragm to provide a ball-type back-pressure valve for cementing.

A forecast of and by the oil industry

THIS FIRST-OF-THE-YEAR editorial was written for us by top executives of the petroleum industry.

Their statements, prepared exclusively for The Oil and Gas Journal, were printed in full in last week's issue.

All we are doing here is summarizing. And that is easy because of the unusual unanimity of opinion among the industry's leaders. In essence, all of them express these thoughts:

DEMAND FOR OIL in 1961 will be only modestly greater, in percentage or in barrels, than last year. But the industry recognizes this and will take more care not to overshoot the mark.

Volume is not the sole factor in the industry's health, and percentage gain in demand is not the true measure of its strength. It is possible to make profits without big increases in output.

The physical conditions surrounding the oil industry will not be much different from those of the past couple of years. Capacity to produce, to refine, and to distribute will remain well in excess of demand.

The difference this year is in the industry's attitude and in its internal operations. It knows that it must manage its surplus; that it must hold down costs.

The austerity conditions of 1960 have made a chastened and a tougher industry. It has learned lessons, and can profit from them in more realism, self-discipline, and statesmanship.

The record of 1961 will depend on how operators in all divisions, individually, handle their business; whether they are alert to changing conditions and take a mature and diplomatic approach to their problems.

The biggest problem is still coping with excess capacity. This calls for great judgment in evaluating markets and inventories; and investment to increase efficiency rather than add capacity.

Competition within the industry and with other fuels will be even sharper, and this calls for more cost cutting, more efficient marketing, and programs to stimulate demand and create new markets.

The year is starting with more favorable than unfavorable factors. Producing and refining rates have recently been more in line with demand, inventories have been reduced, prices have reversed their decline, and the outlook for profitable operations is brighter.

THIS ADDS UP to caution rather than pessimism, to optimism tempered with hard-headed realism.

It is a forecast that, if the industry works hard to make it so, 1961 could turn out to be a pretty good year.

To keep drilling costs down as wells go deeper, use 4340 nickel alloy steel drill pipe

Keeping cost-per-foot down is a tough challenge when you're drilling to 15,000 feet—or deeper—to bring in a well.

When high drilling costs threaten to make today's extremely deep wells uneconomical, drillers need extra ingenuity *plus* stronger, tougher equipment.

Drill pipe made of 4340 nickel alloy steel is an important cost-cutter. With this steel you get a reserve of strength for dependable penetration of extra thousands of feet: basic resistance to fatigue, impact, and abrasion.

Here's why more and more operators are using 4340 drill pipe for deep-hole drilling. This 1.85% nickel steel, readily heat-treated to high yield strengths, stands up to the *severest* torsional and impact stresses. Strong *and* ductile, it takes shock-loading in stride.

When you order drill pipe for your next deep well, remember that 4340 nickel alloy steel has *proved* dependable in the toughest drilling service ... *wells as deep as 25,000 feet.* It's your best insurance against drill-pipe failure.

THE INTERNATIONAL NICKEL COMPANY, INC.
67 Wall Street New York 5, N. Y.

INCO NICKEL

NICKEL MAKES STEEL PERFORM BETTER LONGER

Outlook for '61: A Little Better

Journal Capsule Forecast

Demand: Up 2 to 3%.

Production: Crude, up 250,000 to 300,000 bbl. daily; gas liquids, up 60,000 bbl. daily.

Prices: Could go up for both crude and products, largely due to higher costs, especially labor.

Drilling: Up 1%, with emphasis on wildcatting. Could increase after midyear if higher prices increase income from production.

Capital Spending: Up 6 to 8% over-all, with sharp increases in refining, petrochemicals, and gas pipelining.

Natural Gas: Production up 5%, prices up even more as higher-priced new gas is committed to markets.

Abroad: Greater increases in demand than here, with biggest growth in western Europe. Middle East gains in production will be limited by rising North African output. Around the world: A good year, but with radical changes in marketing patterns.

THE OIL industry will find 1961 a fair year—not booming but still better than 1960.

Most economists believe the fortunes of oil will move up and down with the nation's economy.

On this rule of thumb, they see a slow first half with a good pickup starting in early summer that should lift the industry above 1960 levels.

It's too early for a precise forecast. Company budgets aren't completed, and 1960's figures haven't yet been compiled. But preliminary planning is based on these conclusions:

. . . **In the United States,** demand will rise 2% or more; crude-oil production will rise by more than 250,000 bbl. daily; drilling will show a slight gain; prices might well go up on crude, followed by products. And capital expenditures will increase sharply.

Capital expenditures will be up sharply in refining, petrochemicals, marketing, and natural-gas pipelining. Spending will be off slightly in drilling and production.

On the political front, change is the expectation. There will be new faces, new problems—and new emphasis on such old subjects as depletion, divorcement, and regulation.

. . . **Abroad** the picture is brighter, but with more change in store. Western Europe will lead the world in the increased demand for energy, and North Africa will move forward as an important supplier. Elsewhere demand gains also are likely to outstrip the United States. The big change will be in traditional marketing patterns.

1. Domestic Outlook

Key to field activity will be what happens to gross income from oil and gas production.

Most economists are counting on a modest gain in domestic petroleum demand of about 2%. They expect imports to be held near present volumes, leaving the increased demand to be met with crude and natural-gas liquids.

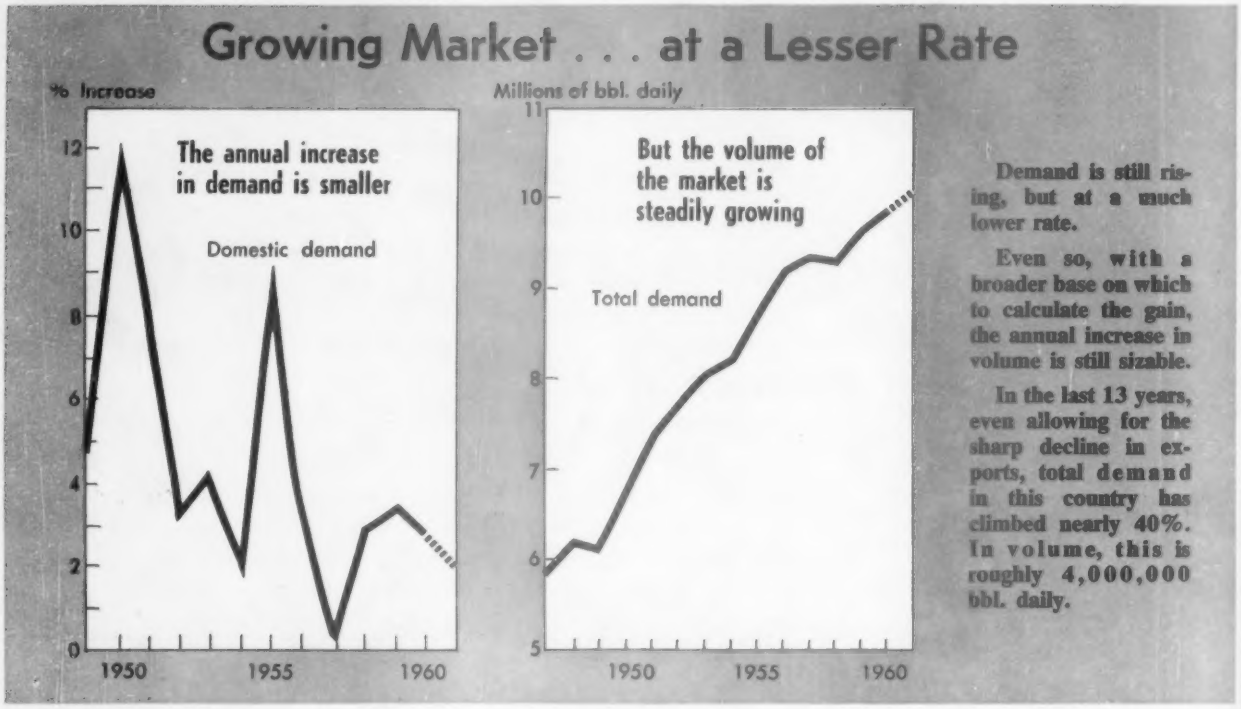
Production, however, should actually increase more than demand because in 1960 the industry drew about 15 million barrels of crude from storage to meet demand.

Thus, producers in 1961 will be called on to meet increased demand and also to replace some of their inventory. This should allow about a 5% increase in production.

Output of natural-gas liquids is expected to increase by 6% providing about 65,000 bbl. more daily for the new market and allowing a 300,000-bbl. daily expansion for crude.

Natural-gas production also is expected to rise by 5%; but since some of this will be new gas coming to market, it will have a higher price. That should mean an 8% increase in the revenue from gas production.

A number of oil economists feel that domestic crudes may increase



in price during the year, followed by a jump in product prices.

The 5% increase in wages now being announced by a growing list of oil companies will boost the industry's operating costs by millions of dollars. Most companies are quick to point out that the economics of the industry do not justify the blanket raise and the only way the new costs can be met is through higher prices.

Impact on drilling . . . Any increase in drilling will depend on the amount of income generated by the domestic industry.

If operators are able to step up their production or get a crude-price increase, look for drilling to pick up in the last half of the year. This particularly will be true of independent operators in this country who won't be in a position to spend their U. S. income abroad.

Preliminary reports to The Oil and Gas Journal indicate about a 1% increase in drilling. The smaller companies say they expect to drill 10% more wildcats but will do less development. The larger companies estimate their wildcatting will increase by 12% but development drilling will decline by 5%.

These estimates naturally are subject to revision later in the year when the income trend can be charted more accurately. Nonetheless, this general conclusion may be drawn about drilling in 1961: More emphasis will be put on exploration drilling than in 1960 with more of the drilling budget being allocated to it.

Operators feel they have sufficient production under existing economic conditions but still lack sufficient reserves for future demand.

Spending to rise . . . Some surprises are brewing in capital expenditures this new year.

Refining is turning up sharply in new investment plans, and petrochemicals are taking a larger chunk of the oil budget this year.

Drilling and production combined may show about the same outlay when all returns are in. So far, reports from predominantly major companies indicate a 4% lower budget for these two divisions. Independents will probably offset this downturn.

In refining, a sampling of 62% of the industry's total capacity shows a sharp jump of 35% from 1960's expenditures. This figure does not include foreign investments, nor does it include petrochemicals.

In petrochemicals, new-plant construction by oil companies will be more than 70% higher than in 1960. This, of course, does not reflect the growth rate of the entire chemical industry, but it does underscore the rapidly growing interest in chemicals on the part of oil companies. Some are planning sizable chemical investments for the first time in 1961.

Natural-gas pipelines loom as important in the transportation picture. This will be another big year, with investment in gas lines overbalancing a decline in other transport capital to give an over-all total about 14% greater in 1961.

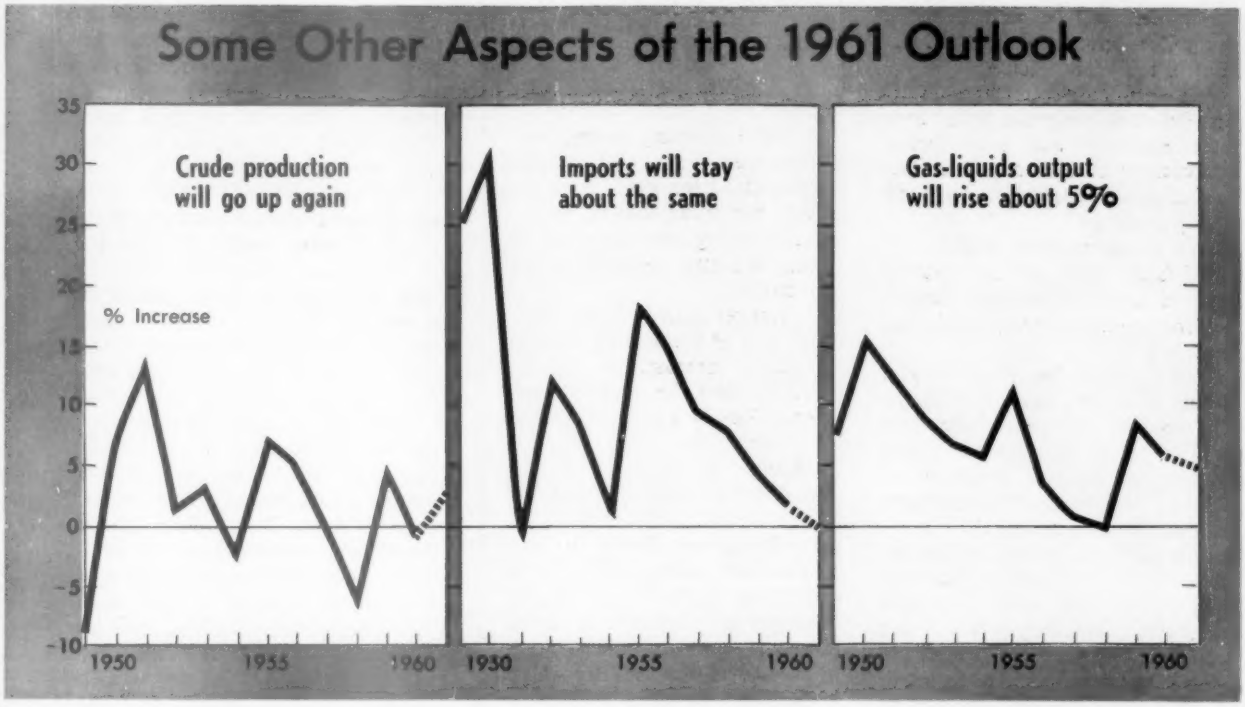
For the industry as a whole, it is likely that 1961 will see an increase in capital spending on the order of 6 to 8% this year—a fairly surprising vote of confidence in future oil and gas markets in this country.

2. Political Outlook

One of the big uncertainties for the industry is what will happen when the new administration and a new Congress take over in Washington in January.

Obviously, with a new set of government officials, changes are likely.

These changes may be in the development of new government oil policies, or they may be changes in interpretation or emphasis of existing procedures.



The change in administration is even more important now than in past years because of the increasing involvement of the Government in oil operations, particularly by the executive branch.

For example, since the last change in administration in 1952, the Government has taken control of the rate of oil imports and of prices for natural-gas producers.

These two moves alone give the Government greater power over the oil industry.

One of the safest predictions in Washington is that such government intervention affecting oil will increase, not decrease, in the years ahead.

The question, then, is what form this government action will take.

White House action . . . The new administration is likely to move cautiously during the early stages.

Here is how it looks now:

The administration's first move will be an effort to eliminate any sag in the domestic economy.

One step being considered is a "quickie" tax cut, even though this would push the budget right back into the red.

This would be followed by an attempt to overhaul the tax structure to provide more revenue. And when this move comes, oil's percentage depletion will again undergo close scrutiny.

A part of the tax and revenue problem, too, will be the question of financing the national highway program. It is unlikely that the new leaders will want to let building slow down, so the question of where to get the money will become paramount. As a result, the 4-cent federal gasoline tax is likely to stay at 4 cents—if it doesn't go up.

Rules on expense account tax deductions may be tightened, but regulations governing write-offs for depreciation may be broadened and liberalized to encourage capital expenditures.

There will be many other changes as the administration moves along and its people gain more knowledge of their roles.

These could involve the regulatory agencies and the programs of Interior, Commerce, State, and Defense.

For example, one of President-elect Kennedy's first actions was the appointment of James M. Landis to make a study and draft proposals for improving the operations of the regulatory agencies.

Last week Landis made his report, calling for some sweeping changes (p. 50).

This may result in a revision of the structure of the Federal Power Commission, the Federal Trade Commission, and others. More likely, it will change the emphasis on policy.

And certainly the role of Stewart Udall as Secretary of Interior will be important, because he will be calling signals on such problems as import controls, public-land leasing regulations, development of the helium program, and others.

It is likely that Udall will play a key role in the proposed over-all study of the nation's fuels-energy picture. This could develop into a move to shape the future pattern for oil, coal, and gas resources.

New faces at the Justice Department and the Federal Trade Commission will mean new attitudes and opinions on such matters as antimerger action and competitive practices.

Congress . . . How fast and how far the new administration will move in many fields depends on Congress.

A reluctant Congress could slow the Kennedy machine immeasurably, or it could help it gain momentum.

Most Washington observers think Congress will tend to be a check-rein.

But there will be more pressure on the Democrats now, with a Democrat in the White House.

And you can expect renewed efforts by such congressmen as Sen. Estes Kefauver and Rep. James Roosevelt to push through their pet legislation affecting marketing and pricing practices.

This means another challenge of "good faith" price cuts and another move to divorce integrated companies from some of their marketing roles.

And of course Sen. Paul Douglas of Illinois or Sen. John J. Williams of Delaware will renew their attacks on percentage depletion, probably by the oft-used maneuver of tacking a percentage-cut amendment on some revenue measure.

This does not mean, of course, that oil's foes will have a field day. They may be no more successful than before. But they will give it a good try.

As it stands now, there seems to be little hope for any gas bill in 1961. The FPC's area-pricing approach and Landis' proposed changes in regulatory machinery will give Congress reason for avoiding this hot-potato issue.

Congress in 1961 will also be called on to deal with another controversial oil issue: Offshore submerged boundaries.

Alabama, Louisiana, and Mississippi will press for legislation giving them the same 3-league boundary the U. S. Supreme Court authorized for Texas and Florida.

3. The Picture Abroad

Trends for oil in other sections of the world are set.

The Eastern Hemisphere will again contribute the major growth in nearly all phases, just as it did last year.

This now-traditional growth will come in every segment of the industry as the energy demands of Europe, Africa, and most of the Far East continue to grow at a faster rate than other parts of the world.

New, and not at all traditional, factors will make themselves felt for the first time in 1961. New sources for the oil needed by this part of the world have appeared for the first time. This new oil, both for Europe and for Japan, the Far East's leading consumer, is going to cause some juggling in marketing concepts as new producers begin to peddle new oil.

Barring a major economic upheaval that would stall an already booming economy, western Europe will continue to lead the rest of the world in growth of oil consumption. The underdeveloped nations of Asia and Africa will keep growing but at a smaller rate than in Europe.

Western Europe will continue to see petroleum displace coal as a primary energy source, and this industrially expanding region of the world is almost certain to show another increase of 10% or more in oil consumption, following the pattern set shortly after World War II.

The new supply . . . The switch that will come is in new sources of oil supply for Europe. For the first time North African oil will make itself felt in Europe. This is going to mean that Middle East production, rising steadily to meet Europe's energy needs, will begin to grow at a slower rate than it has experienced.

The big jump in new oil supplies will come in the French Sahara, which now has two 24-in. pipelines fully operational. The second line linking the Sahara's eastern oil fields with a shipping terminal in Tunisia went on stream in the last quarter of 1960, and the impact of this new supply wasn't really felt.

It will be felt in 1961 when the Edjele pipeline will move at least 170,000 bbl. daily with the addition of a second pump station in April.

This new North African oil, added to a similar amount from Hassi Messaoud field, will show up in European markets for the first time in volume in 1961. Much of it will be absorbed by the French market, but France is going to make every effort to move franc oil into other European market places, too.

In addition to the Saharan production, Libyan oil will make its first appearance in 1961. Esso Libya should have its big 30-in. pipeline from Zelten field to the Mediterranean in operation by mid-year. Initial throughput of this line will not be in the same class with the throughput of more mature French Saharan operation, but Esso will undoubtedly be able to ship 50,000 bbl. daily by the time the line is completed.

The appearance of this new oil is going to cut a real slice from the gain that Middle Eastern producers normally would experience. But with European consumption alone expected to expand more than 300,000 bbl. daily, there should still be room for further growth in the Middle East.

New growth . . . Additional oil consumption throughout the Eastern Hemisphere will carry with it the necessary expansion in refining, pipelines, marketing, and chemicals.

New refining capacity is slated for nearly every section of Europe. The same is true for Africa.

Plans are under way to provide new refineries, most of them at local government insistence, in many smaller countries of Asia. The refinery construction boom in Japan will continue into 1961 and for several years afterward.

The new year holds every prospect for the same kind of growth for this half of the world that it has experienced for the past 5 years, but beginning with this year there are going to be radical changes in marketing patterns.

New faces with new oil production will be clamoring for a part of the growth, and the new faces are bound to have some of it.

For final figures . . .

Review—Forecast

Some company budgets and operating plans still haven't been fixed for 1961. As a result, the predictions in the accompanying story are based on only a partial sampling of the industry.

It takes nearly a month after the end of the year to firm up specific forecasts of activity. That's why the Journal's annual Review-Forecast number usually appears on the last Monday in January.

Your January 30 issue will contain all the final figures on 1960 operations—plus the Journal's annual forecast of drilling, capital expenditures, supply and demand, crude-oil production—and all the other aspects of the industry you'll need as a guide for the coming year.

Mecom Shoots for 26,000 ft.

Drilling Starts in Deepest-Well Attempt

JOHN W. MECOM is on his way to 26,000 ft. with a drilling program he hopes will get him there. The well will cost at least $2 million.

The first 3,000 ft. has been a breeze. The rest will be another matter.

Drilling engineers for the big Houston independent disclosed last week a portion of the program they hope to follow in the deep South Louisiana test located just a short distance from a former world depth record holder.

Mecom has an advantage over the drillers of the Richardson and Bass well, drilled in 1955 to 22,570 ft. When 1 LL&E Humble "L" went to that depth, it did so without pre-planning. It had been programed to 15,000 ft. or less.

The new well, located 8,000 ft. east of the 1 LL&E and 4 miles south of Port Sulphur, is prepared to go deeper than man has ever drilled before. The present record was set in 1958 by Phillips Petroleum Co.'s 25,340 ft. dry hole in Pecos County, Texas.

So far . . . Drilling started in the swamps of Homeplace field in mid-December with a huge Mecom steam rig.

The operators used a 15-in. bit to drill to 200 ft. and then reamed to 28 in. before setting 24-in. conductor casing.

Next the 15-in. bit went to 2,982 ft. for the surface casing. The hole was reamed to 22 in. and 16-in. casing set. The 2,982 ft. length may be the greatest ever set of 16-in. pipe.

To hold the heavy load of 233,000 lb. (1,987 ft. at 75 lb. per foot and 995 ft. at 84 lb.) the operators used the equivalent of 3,900 sacks of cement from the bottom to the surface.

Anticipated . . . Last week the 15-in. bit was moving below the conductor casing enroute to 13,500 ft. where the operators will install what is probably the longest string of 10 ¾-in. casing ever used. The upper 6,500 ft. will be 55.50 lb. N-80 buttress thread pipe and the lower 7,000 ft. will be regular 55.50 lb. N-80.

The pipe has a burst pressure of 6,750 psi. and a safety factor in tension at the top of 1.7.

Mud weight for the wide-hole drilling to 13,500 ft. is starting at 14 lb. per gallon and will increase to 17.5 lb.

Below 13,500 ft. Mecom will drill a 9⅝-in. hole to at least 22,000 ft. and then underream to 11⅝ in. before running an 8⅝-in. liner. The hole is a big one of course, for such great depth, but the operators believe they will need it on any program taking them to a near 5-mile record.

They will continue as far as possible with the 8⅝-in. and then drop to 6⅝-in. And, if absolutely necessary, a drop to 4½-in. will be made.

No definite rotary speed program has been established.

The operators expect to reach total depth in 296 days.

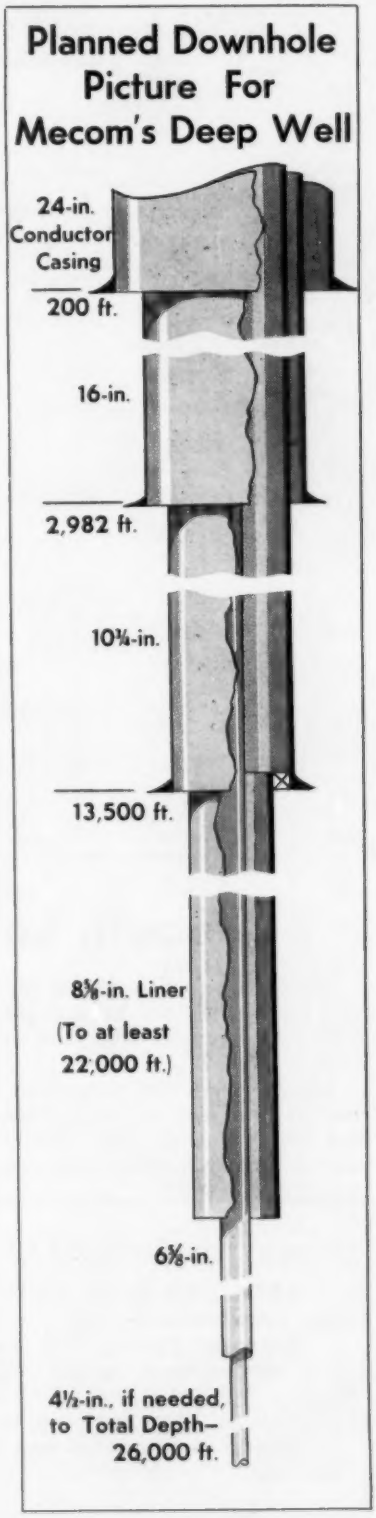
One problem they must face is high temperature at the 20,000-ft. depth and beyond. Some South Louisiana engineers speculate highs of 425° F. at 20,000 ft. and up to 500° F. at 26,000 ft. which would be the highest ever recorded. It is certain to create expensive mud problems.

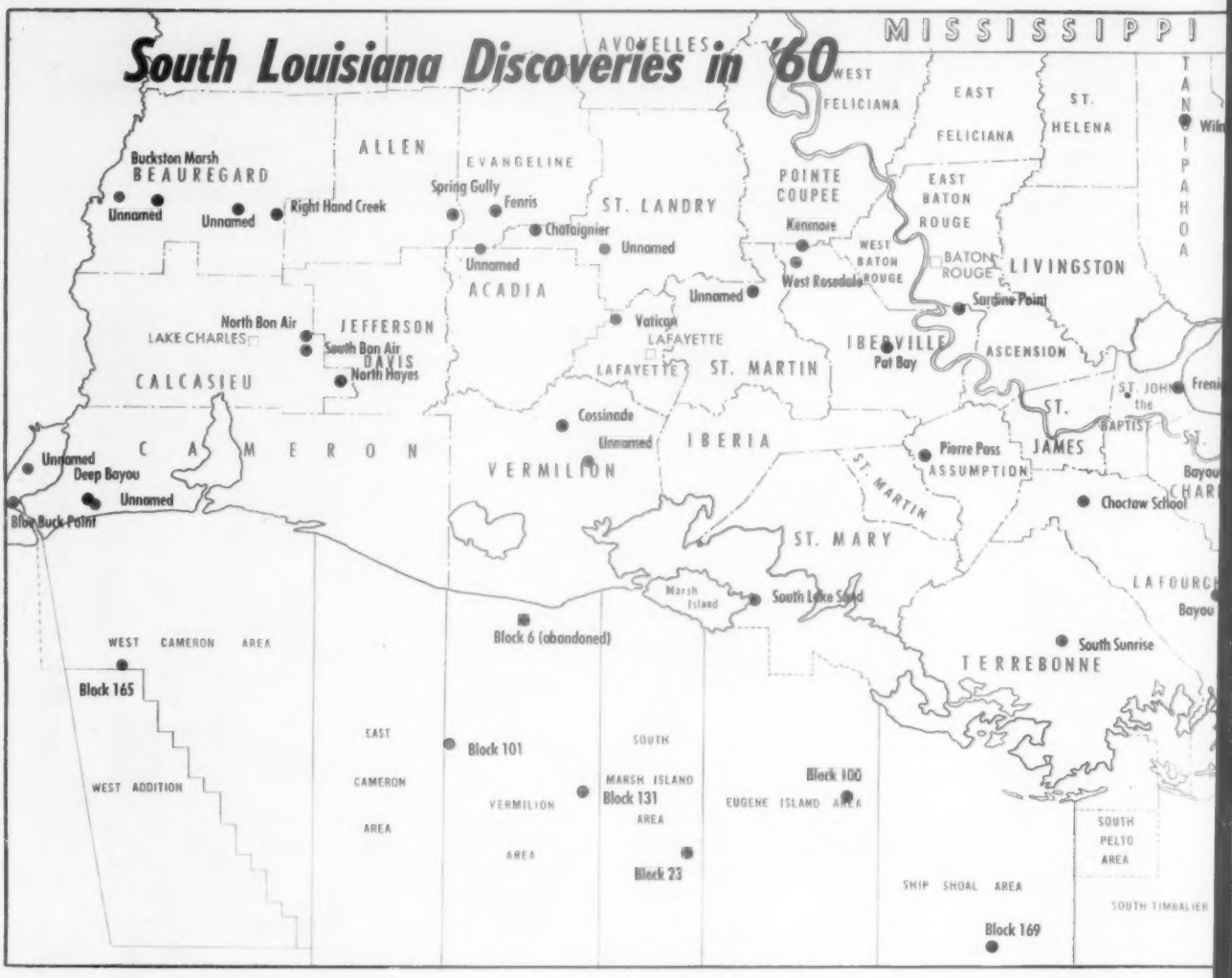
Management . . . U. S. Oil of Louisiana, Mecom's Louisiana company, is operator for the project.

Mobil Oil Co. has an interest in the undertaking, at least to 20,000 ft.

Estimated cost of going to 26,000 ft. is $1,750,000, while another $250,000 would be spent on completing the well.

Mecom has not released geological data and prospects on the well, but the area now has the deepest producers in the world at close to 20,000 ft. The 1 LL&E once produced at around 22,000 ft. but now has collapsed pipe in the bottom of the hole and has been hard to produce. Reworking the hole is scheduled after the current 26,000-footer is finished.





South Louisiana Seesaw: Discoveries Go Up,

LOUISIANA'S rich coastal belt paid off with 42 new oil and gas fields last year, six more than in 1959.

Several other 1960 discoveries, now set up as long extensions, may turn out as separate fields. And at least a half-dozen other indicated new fields can be credited to last year's wildcatting, although they will be logged on the 1961 list if they prove out.

Considering that an offshore-drilling slump has been going on for the past 2 years, the 1960 showing was a good one.

Discoveries in the area reached a crest in the 1955-58 period. They were swelled by highly successful explorations in offshore zones. But a combination of factors cut down this type of drilling in 1959-60, and only a few offshore fields were added to discovery records.

The shoreward side of the coast accounted for 35 of last year's new-field discoveries, compared with 32 in 1959. This part of the coastal belt continues to be a fertile hunting ground for oil and gas reserves despite intensive drilling operations that stretch back to the turn of the century.

Altogether, 263 wildcats were drilled in the entire belt last year. Of these, 232 were onshore wells and 31 were in offshore areas. This

Have You Noticed Our New Look?

WITH THIS ISSUE, the Journal introduces a larger type size and a new slotted binding.

Increasing type size from 9 to 10 points allows easier reading. And elimination of the old wire-stitch binding gives you these advantages: The magazine lies flat when open, pages can be torn out smoothly for filing, and permanent binding will be easier.

Months of study went into these improvements. We hope you like them.

Completions Fall

compares with 222 onshore wildcats and 15 offshore wells in 1959.

More than 2,050 total wells were completed in the coastal regions as a whole in 1960, nearly 100 less than 1959's total of completions. There was a 1960 increase in offshore drilling—more than 80 wells. But this was offset by the decline in onshore completions during the year.

Altogether 743 fields have been discovered in South Louisiana—624 on the landward side and 119 in offshore areas.

Although the trend in South Louisiana's deeper development has been toward gas and condensate production, 18 of 1960's 35 onshore new-field discoveries were oil productive.

Where Finds Were Made

PARISH, FIELD, AND DISCOVERY WELL	PRODUCING DEPTH	TYPE PROD.
Acadia		
Unnamed—W. W. F. Oil Co. 1 M. Jenkins Est.	8,471-74	Gas
Allen		
Spring Gully—J. P. Owen Co. 1 Hammie Guidry	7,825-31	Oil
Assumption		
Pierre Pass—Union Texas 1 State 3426	[12,124-32]	Oil
	[13,210-44]	Oil
Beauregard		
Buckston Marsh—Highland Oil Co. 1 Newport	7,587-90	Oil
Right Hand Creek—Lyda Hunt-Herbert 1 McPherson	8,672-78	Oil
Unnamed—H. L. Hunt 8 Lutcher-Moore	7,648-51	Gas
East Longville—Jeff. Lake Sulphur 1 Lyles	8,962-70	Oil
Calcasieu		
North Hayes—Calco 1 Desire Lorraine	10,528-42	Oil
South Bon Air—Superior 1 Farmers L. & C.	10,088-93	Gas
South Iowa—H. L. Dillon 1 Boudreau	9,743-48	Gas
Cameron		
Deep Bayou—Texaco 1 Cameron Meadows	8,231-34	Oil
Unnamed—Shoreline Exp. 1 Maier	7,655-61	Gas
South Sabine Lake—Calco 1 State 3463	11,320-30	Gas
Blue Buck Point—Calco 1 State 3565	7,953-70	Gas
East Baton Rouge		
Sardine Point—Calco 1 Ferro	9,679-84	Oil
Evangeline		
Fenris (N. Basile)—J. P. Owen 1 Fontenot	8,038-44	Oil
Unnamed—J. P. Owen 1 Edgar Miller	10,027-33	Gas
Iberia		
South Lake Sand—Shoreline Exploration	14,843-47	Gas
Iberville		
West Rosedale—Anderson-Prichard 1 Albritton	9,996-10,064	Gas
Pat Bay—F. A. Callery 1 Wilbert	10,112-16	Oil
Jefferson		
Bayou Segnette—Anson Petroleum 1 Celatex	9,196- 9,202	Oil
Lafayette		
Vatican—Arkansas Fuel 1 Hernandez	10,951-69	Gas
Lafourche		
Point Chicot—Pioneer Oil & Gas 1 Jones	[10,952-61]	Gas
	[10,790-96]	Oil
Bayou Poignard—California-Sinclair 1 Jones Unit	11,587-602	Gas
Choctaw School—Sohio 1 Rathborne	12,407-17	Gas
Plaquemines		
South Adams Bay—Anderson-Prichard 1 State 3091	13,356-65	Oil
Pointe Coupee		
Kenmore—Discovery O. & G. 1-A Buffington	9,192-95	Oil
St. John		
Frenier—F. A. Callery-Pioneer 2 Lutcher-Moore	9,037-41	Oil
St. Landry		
Chataignier—Halbouty 1 H. E. Kosh	8,601-05	Oil
Unnamed—Amerada-Forest 1 Ned Pellerin	10,902-22	Gas
St. Martin		
Unnamed—E. Cockrell, Jr. 1 St. Martin Ld. Co.	12,058-63	Oil
Tangipahoa		
Wilmer—Floyd Williams 1 Lake Superior	12,175-94	Oil
Terrebonne		
South Sunrise—Superior 1 Robt. Milling	16,684-94	Gas
Vermilion		
Cossinade—Sohio 1 Bracquet	11,817-24	Oil
Unnamed—Tennessee Gas & Oil 1-A Detraz	14,717-32	Gas

OFFSHORE AREA, FIELD, AND DISCOVERY WELL		
West Cameron		
Block 165—Tennessee Gas & Oil 1 OCS-0758	[9,782-94]	Gas
	[9,810-16]	Gas
Eugene Island		
Block 100—Shell 2 OCS-0796	12,292-98	Oil
Ship Shoal		
Block 169—Gulf 1 OCS-0820	9,270-78	Oil
South Marsh Island		
Block 23—Gulf 1-A OCS-0778	[12,000- 22]	Gas
	[11,690-735]	Gas
Vermilion		
Block 6—Humble 1 State 3512	14,900-12	Oil
Block 101—Union 1 OCS-0564	7,494-7,500	Gas
Block 131—Socony-Mobil 1 OCS-0775	[11,070-78]	Gas
	[11,367-70]	Gas
	[11,435-37]	Gas

Note: Bracketed figures in next to last column mean multiple completions.

Regulators May Feel Kennedy's Broom

• President-elect names Landis new czar of regulatory agencies. Judging from the critical nature of Landis' report, especially concerning FPC policies, the industry is in for a new round of change—and some long-reaching effects.

PRESIDENT-ELECT Kennedy last week named James M. Landis a special assistant to "effect reform" in regulatory agencies.

Landis, a former Harvard Law School dean and a former member of several regulatory groups, will work on a part-time basis as a White House aide. He will recommend changes that Kennedy may convert into requests for legislative action.

Besides appointment of a "czar" to ride herd on the work of these agencies, Kennedy may also set up high-level offices of near-cabinet rank to draft proposed national policies affecting energy, transportation, and communication.

Any or all of these developments could have a major impact on the oil and gas industry.

The first possibility of such planning by the President-elect was signaled by recommendations drafted at his request by Landis. The report made public last week, was given close study by the Kennedy team.

Before Kennedy announced his appointment of Landis as a special aide, there had been speculation he would do that very thing.

What's wrong now . . . Landis, in his report, was sharply critical of the present functioning of the regulatory agencies.

He criticized their lack of established policy, their slowness to act, and their tendency to be dominated by the industries they are supposed to regulate.

He was particularly sharp-tongued with the Federal Power Commission.

"Without question," he said, "the FPC represents the outstanding example of the breakdown of the administrative process."

He accused the FPC of an unwillingness to assume its responsibilities under the Natural Gas Act. And he said it had sought to ignore the mandates of the Supreme Court and other federal courts on matters affecting gas regulation.

Landis said the pile-up of cases at the FPC has stemmed largely from the commission's inaction, its attitude, and its failure to use the power it has to speed the disposition of cases.

In other words, Landis clearly believes that the FPC has been dragging its feet deliberately.

He said the recent move by the commission toward an area-pricing approach "has come far too late to protect the consumer."

Proposed cures . . . Landis outlined a number of proposals.

The first step would be to seek congressional authorization for Kennedy to reorganize the agencies as he sees fit, subject only to veto action by both houses.

Then, for the FPC, it would be made clear that the tenure of the chairman would be "at the pleasure of the president."

The FPC chairman, as well as the chairman of other regulatory agencies, would be given more authority over administrative matters within the agency — including appointive power over virtually all of the agency's personnel.

Finally, the agencies would be reorganized so that a commission's authority could be delegated to panels of its commissioners, to hearing examiners, or other qualified personnel.

To make the panel approach feasible, Landis would increase FPC membership from its present 5 to 7.

Landis would also lengthen the terms of the commissioners to 10 years.

Energy policy . . . Landis recommended the creation of an office for the coordination and development of a national energy policy. It would have authority to propose to the President plans for the development of the energy resources of the nation.

One purpose of the office, which would be directly responsible to the President, would be to press for new sources of energy "such as the hydrogenation of coal and oil-bearing rocks, and also the wider employment of atomic energy."

Landis also urged the coordination of government action affecting fuel resources and their uses.

Prospects for action . . . There is little reason to expect that any major overhaul of the regulatory agencies or development of new over-all energy policies will occur in the months just ahead.

First, Kennedy himself will have to decide which of the proposals made by Landis and others he will press for.

Then, on those matters requiring congressional action, there will be the usual time-consuming legislative processes involving hearings, committee consideration, and voting action.

Finally, there would be the problem of drafting specific procedures and of selecting men to put them into effect.

PROCESSING

A new delayed coker for Champlin Oil & Refining Co. will be built by Fluor Corp. Ltd. The $1½ million contract will be supplemented by Champlin personnel in an over-all $3 million expansion of the 33,000-bbl. per day refinery at Enid, Okla.

British American Oil Co. has placed on stream a 15 M.M.c.f.d. capacity dry desiccant, short-cycle hydrocarbon unit near Gilby, Alta. The unit is designed to recover 210 bbl. per day of stabilized condensate.

A new jet fuel anti-icer developed by Phillips Petroleum Co. has been approved by the Air Force for the Strategic Air Command. Sufficient quantities are available to meet the needs of commercial jet aircraft and guided missiles. Called PFA 55MB, the chemical additive prevents in-

Long Island Pipeline Near?

- Investment firm shows keen interest in plan for moving New Jersey refinery products to the populous island.

A NEW YORK investment company is reviving an old plan to move products from New Jersey refineries to Long Island and its two big airports, Idlewild and La Guardia.

Carl M. Loeb, Rhoades & Co., investor in a number of petroleum enterprises, has taken over the East Coast Pipe Line Co. and is financing a study for a 20-in. 75-mile line that would cost some $30 million.

Gulf Interstate Co., a Houston engineering firm, has been hired to make the study. Loeb, Rhoades wants to find out how the proposed common-carrier line could be operated profitably.

The study will be completed shortly. If results are favorable, the line will be built this year.

The first effort to build such a line was headed by Victor Gallucci, New York pipeline contractor who had links with engineering and railroad interests. Gallucci went so far as to build two 24-in. crossings off The Narrows between Staten Island and Brooklyn.

One of these lines has been leased to Consolidated Edison for utility lines. Loeb, Rhoades has taken an option on the other.

Originating in the Linden, N. J., refining area, the proposed new line would move jet fuel, automobile and aviation gasoline, home heating oil, and other products into the thickly populated Long Island area now served by barge and rail.

Gulf Interstate, which might participate with Loeb, Rhoades in ownership of the line, is working on a design of about 225,000 bbl. daily plus another 75,000 bbl. on peak days. The line eventually might tie in with the Buckeye and Harbor Products systems in the area.

One of the factors which makes the project attractive is the heavy demand for jet fuel at Idlewild Airport where consumption has reached some 50,000 bbl. daily.

BRIEFS . . .

flight ice formation without affecting the thermal stability of jet fuel.

Contract has been awarded for a natural-gasoline plant which will be built by Northern Gas Products at Bushton, Kans. Fluor Corp. has received the award. The plant will be able to handle 896,000 M.c.f. daily.

Sun Oil Co., Ltd., will build a 2,600-bbl.-daily heating oil hydrodesulfurizer at its Sarnia, Ont., refinery. Scheduled to start operating in May, the $700,000 unit will use a Sun process.

Two gas-liquids plants will be built by Shell Oil Co. in South Texas. One, serving North Rincon and La Coptia fields in Starr County, will process 35 million cubic feet daily and recover about 80% of the propane and all heavier liquids. The other, serving Sealy field in Austin County, will be a joint venture with Arkansas Fuel Oil Corp. and others. It will handle 16 million feet daily, recovering 6,300 gal. of propane, 8,600 gal. of depropanized gasoline, and 6,000 gal. of distillate.

Facilities for producing bromine from oil-field brines will be constructed near El Dorado, Ark., by Arkansas Chemicals, Inc., a company formed jointly by Houston Chemical Corp. and Great Lakes Chemical Corp.

Preliminary work has started on a 5,000-bbl. hydrotreating unit which will be built at Shell's Martinez refinery near San Francisco. The unit will use a Shell process for reacting hydrogen with lube oil at high temperatures and pressure.

Also for Refiners . . .

IN THE NEWS: Firmer prices for crude and products are forecast for 1961 (p. 43) . . . Imports of crude will decline only 19,260 bbl. daily in the first half under new rule (p. 54) . . . Current round of wage raises will cost the oil industry more than $200 million per year (p. 55) . . . Refinery runs in Southwest show a slight drop for November (p. 56) . . .

PLUS THESE TECHNICAL REPORTS: How shell will clean up its waste water (p. 72) . . . Maintenance planning saves for Ethyl (p. 78) . . . Corrosion tests speeded by ultrasonics (p. 88).

First Mohole Project Contract Let

A CONTRACT has been let for experimental drilling in 12,000 ft. of water as a first test step in the Mohole project—a plan by scientific organizations to drill through the earth's crust and into the mantle.

Global Marine Exploration Co. of Los Angeles will do the drilling, using CUSS I, which is being modified for the test. Drilling is to begin in March.

The test site is near Guadalupe Island, off the western coast of Mexico.

No effort will be made in the first test to penetrate deeply into the ocean floor. Rather, the purpose will be to test the ship and equipment in deep-water drilling.

Drilling will be done with the ship unmoored, holding its position by means of four large outboard motors at the corners of the ship.

Standard rotary drilling methods and diamond bits will be used. The hole will not be cased, so sampling and measuring operations will be done by lowering tools and instruments through the drill pipe.

If the first test is successful, other tests will be made before the actual attempt to drill through the earth's crust is attempted. The latter phase is still several years away.

TGT Asks Mexican Line Permit

- **Competitor of Texas-Mexico-California line pops up as a new firm proposes project for an all-Mexican line.**

TENNESSEE Gas Transmission Co. is moving swiftly to bring its Texaco-Mexico-California pipeline project to reality. Failure to act quickly could result in another pipeline proposal—and another company—making headway with the Mexican government.

As things stood last week the Tennessee Gas plan was still firmly supported by Petroleos Mexicanos and Southern California Edison, both of which have signed agreements making the international pipeline possible.

But Pemex Director Pascual Gutierrez Roldan let it be known in Mexico City that he has received a proposal to construct a gas pipeline from Reynosa southward beyond Durango, and thence to the Mexican West Coast and northward through several western Mexico cities and into California.

This route might be more advantageous for Mexico, but its practicability is questionable. It is based on the theory that no Texas gas would be used.

The Tennessee Gas project calls for moving gas out of South Texas, picking up Northwest Mexico gas around Reynosa, and then transporting gas through a pipeline that would skirt northern Mexico until it entered southern California near Mexicali.

Gutierrez Roldan said the alternate proposal for the more southerly route was made by a firm known as International Gas Co., based in the U. S.

Tennessee Gas and Edison have gone to the Federal Power Commission with three applications that will, if approved, allow exporting of gas from Texas, importing of gas into California, and construction of facilities making exporting and importing possible.

What was filed. Specifically, in these applications:

...FPC was asked by Tennessee California Gas Transmission Co. for presidential permission to build and operate facilities to export natural gas from Texas to Mexico.

...A similar permit was sought by California Gas Transmission Co., another Tennessee Gas subsidiary, for gas moving from Mexico into California.

...Authority was requested by Southern California Edison, prospective purchaser of the gas in California, to export Texas gas to Mexico and to import into California the same Texas gas plus additional Mexican gas.

Earlier Edison had applied to the California Public Utilities Commission for authority to move the gas into California (OGJ, Dec. 12, 1960, p. 96). A hearing is set for January 25.

Eventually the line would have a capacity of 750,000,000 cu. ft. of gas daily. This is some 40% greater than Edison anticipates it will need in the fifth year and thereafter. The excess could be sold in northwestern Mexico and California.

Humble Oil & Refining Co. will be the chief supplier of gas for the line. Its 20-year contract calls for 265,000,000 cu. ft. daily from South Texas. Pemex would supply a minimum of 75,000,000 cu. ft. daily.

FPC Approves Rock Springs Project

THE FEDERAL Power Commission has approved the Rock Springs pipeline project to supply natural gas to southern California.

Under the proposal, El Paso Natural Gas Co. and Colorado Interstate Gas Co. will build pipeline facilities to supply an additional 470 million cubic feet daily to market areas in southern California and increase service to Colorado Interstate's Rocky Mountain customers.

The gas, which would be delivered to the California border, would be sold to Southern California Gas Co. and Southern Counties Gas Co.

Under the proposal approved last week by FPC, Colorado Interstate will build a 155-mile 34-in. line from Rock Springs, Wyo., to Provo, Utah, where it will connect with a 395-mile line to be built by El Paso to the California-Nevada border near Las Vegas.

Colorado Interstate will also build a total of 476.6 miles of line and install additional compressor capacity at new and existing compressor stations to strengthen its present system and provide increased service to customers in the Rocky Mountain area.

CONTACTOR NUMBER 3

AMINE PROCESS DESIGN AND OPERATING INFORMATION

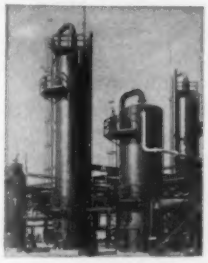
While ethanolamines are an excellent medium for treating gas, their satisfactory application depends on proper use of the amines and correct design of mechanical equipment. Some of these important design and operating considerations will be discussed in this series.

Maximum Stripping in Still is Essential

Insufficient stripping is a serious problem in amine plant operation. If all of the rich solution stripping is not done in the still, then a great deal of it will be done in the reboiler . . . causing very severe tube erosion and corrosion.

Good design calls for two or more stills in parallel to provide correct still area. Fluctuations in still loading can then be met by using one or the other. Economic considerations, however, may prevent this practice.

In cases where a plant is in operation and residual CO_2 in the lean amine goes above 1 cu. ft./gal. of solution, there are three ways to increase stripping:



1. Increase heat to the reboilers which will drive more steam up the column.

2. In a bubble cap column, alternate rows of caps can be blanked off to increase contact efficiency.

3. Increase liquid circulation. (This, however, will also increase steam consumption.)

Blanketing is Beneficial

To reduce oxidation of amine solutions and to avoid attendant corrosion problems, surge tanks, sumps and all parts of the system should be blanketed with oxygen-free gas. Wherever possible, oxygen should be excluded from the gas being treated.

When treating oxygen-containing gas, close attention to reclaimer design is necessary. The capacity of the reclaimer should be sufficient to maintain a low concentration of oxidation products.

Any amine solution which has been recovered from system leaks, and is to be returned to the system, should be returned only through the reclaimer.

Avoid Solution Overloading

Amine treating can be overdone, and any effort to dissolve too much acid gas usually results in trouble. Four cu. ft. of acid gas/gal. of solution is about the limit. Above this amount (in terms of a 15% solution of NEA), the bicarbonate or acid salt forms, aggravating corrosion by pH and CO_2 evolution effects.

Many difficulties can be attributed to improper solution loading. Exceeding the recommended amount for limited periods will not seriously damage a plant . . . providing it isn't done repeatedly.

It has been found in plant operation that it is difficult to justify using a 20% NEA solution (or higher) due to the problem of regeneration. Reference to equilibrium data in NEA literature will prove this to be true.

Low Reactivator Temperatures Reduce Corrosion

Because CO_2 and H_2S are inherently corrosive in the presence of water at elevated temperatures, amine reactivator temperatures should be kept to a minimum (235-245°F). These gases require pressures of 8-13 psig. at the base of the reactivator. Holding to this range of temperature and pressure will help in these ways:

1. It will minimize the inherent corrosiveness of the system;

2. Corrosion inhibiting films are less likely to be destroyed;

3. The possibility of thermal degradation with its accompanying increase in corrosiveness is reduced.

With other operating factors at their optimum, the recommended temperature will give good stripping of CO_2 and H_2S. Use of proper temperature will usually eliminate the need for costly alloys in heat exchangers and reboilers.

FOR MORE INFORMATION, look for the next Allied Chemical Contactor.

For specifications and local offices, see our insert in Chemical Materials Catalog, page 272A and in Chemical Week Buyers Guide, page 27.

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Small Cut Made in Imports

. . . for first half of 1961. Producers are certain to ask the new administration for more reductions.

INTERIOR DEPARTMENT last week finally got the signals set for oil-import allocations during the first 6 months of 1961.

Over-all, they represent a small reduction in the total flow of oil imports, but fall far short of what producers had wanted by way of cuts.

After a series of false starts and stops, this was the program that emerged:

A White House proclamation on Christmas Eve put into effect one of the three rule changes that had been proposed by Interior. The change permits an adjustment of quotas when Bureau of Mines' estimates for a previous period turn out to be too high or too low.

The net effect of this rule change is a reduction of 19,260 bbl. daily in the January-June level for Districts 1-4 below what the total would have been for that period under the old rules.

The failure of the administration to act on the other rule changes prevented a further reduction of about 40,000 bbl. daily.

This inaction brought protests from producer groups, that had urged even more stringent measures as a necessary stimulant to the sagging domestic producing industry.

The producer organizations, led by the Independent Petroleum Association of America and the Texas Independent Producers and Royalty Owners Association, are certain to renew their drive to persuade the incoming administration that the program set for the new allocation period permits too high a level of imports.

The producers may press for congressional action if they fail to get action by the administration.

However, until other changes are made in the program, this is the quota picture for the first 6 months of 1961:

In Districts 1-4, crude and unfinished oil imports will be 689,896 bbl. daily. They were 704,328 bbl. daily in the last half of 1960.

Product imports will be 76,634 bbl. daily. This is the same as during the period that ended December 31.

Historical crude-oil importers whose allocations are based on their last allocation under the voluntary oil-import program will get an allocation based on 72% of the last voluntary quota. During the last half of 1960, such importers received 75.7% of their last voluntary allocation.

There will be a slight reduction, too, for importers whose allocations are based on a percentage of their refinery runs. The amount of this reduction depends on input of the refinery.

In District 5, first-half import level will be 228,500 bbl. daily, including 10,619 bbl. of products daily.

This is a reduction of about 11,500 bbl. daily from the total announced by Interior in December. The drop resulted from an administrative change which specifies that demand for District 5 will not include increases in shipments to other districts above the level of such shipments in 1958.

The purpose of this change was to prevent a big boost in District 5 shipments to Districts 1-4 with a resulting increase in West Coast import quotas. As it is now, under the change, any increase in shipments from District 5 into the other districts will not result in higher quotas for District 5 importers.

For Puerto Rico, crude and unfinished oil imports will be 87,611 bbl. daily. Finished-product allocations are for 354 bbl. daily, while the limit for residual fuel oil is 1,644 bbl. daily.

Effective January 1, imports of crude and unfinished oil into Puerto Rico are based on actual imports in July 1958. Previously, the level had been based on the entire third quarter of 1958. Interior said technical reasons made the change necessary.

HOW PERCENTAGE ALLOCATIONS WORK

For importers with allocations based on a percentage of refinery inputs, allocations for the January-June period will be based on this table. Figure in parenthesis is the percentage in the last half of 1960.

Average Throughput (Barrels daily)	Allocation % Throughput
0- 10,000	11.5 (11.8)
10- 20,000	10.5 (10.8)
20- 30,000	9.6 (9.8)
30- 60,000	8.6 (8.8)
60-100,000	7.7 (7.9)
100-150,000	6.7 (6.9)
150-200,000	5.7 (5.9)
200-300,000	4.7 (4.9)
300,000 plus	3.8 (3.9)

Pipe Laid at Oregon Border

CONSTRUCTION of the U. S. portion of a big gas system running from Alberta to San Francisco has begun.

Crews of H. C. Price Co., Bartlesville, Western Pipeline, Inc., Austin, and J. P. Neill Co., Inc., Dallas, laid the first section of 36-in. pipe across the Oregon-California border near Malin, Ore., about 22 miles southeast of Klamath Falls.

The gas system involves several companies. Pacific Gas and Electric Co., San Francisco, is the principal backer.

The 1,400-mile system is scheduled for completion in November.

PIPELINE

A 65-mile, 16-in. gas line has been completed by Continental Oil Co. to connect the Maurice-Milton area of Louisiana with Continental's natural-gasoline plant near Lake Charles. Also finished is an 8-mile line to move residue gas to Conoco's Lake Charles refinery and to industrial customers. Contractor was Panama, Inc. Continental also is expanding its Lake Charles gasoline plant from 100 million to 150 million cubic feet daily.

If the FPC approves, Panhandle Eastern Pipe Line Co. will spend $46,480,000 on new loops and laterals and thereby increase its capacity by 325 million cubic feet. Panhandle wants to build 298 miles of 30-in. loops, 42.8 miles of 16 to 26-in. supply laterals, and some 80

Humble Offers 14-Cent Raise

. . . to union workers. This equals a wage-boost proposal advanced by Sinclair, and no strings are attached.

A WAGE-increase pattern of 14 cents per hour gained an important adherent last week when Humble Oil & Refining Co. made an unqualified offer of that amount to union employes in its eight refineries.

Only one of the refineries—at Baytown, Tex.—is represented by the Oil, Chemical and Atomic Workers Union, while the others have independent unions.

The Baytown workers meet January 3 to act on the proposal, and are expected to accept it.

Humble, the largest domestic oil company and refiner, announced it was raising wages of salaried employes by 5% in some cases and by 14 cents per hour in others. The 14-cent offer is to union personnel and will be retroactive to December 27 if accepted by January 16.

Humble has about 42,000 employes, of whom 15,000 are in manufacturing. Most of those in manufacturing are represented by unions.

The offer by Humble matches that of Sinclair and has no strings attached, Some Gulf Coast refiners have made the 14-cent offer but are insisting on a wage freeze of 1 or 2 years or a renewal of the work contract.

Other companies joining the growing list of those making wage increases include Skelly and Pure. Both announced 5% increases. And Pure President Robert L. Milligan added his voice to those of other company executives who have warned that companies must increase product prices to cover the salary adjustments.

It's difficult to compute the exact cost of the salary increase to the entire oil industry, but conservative figuring puts it at more than $200 million per year.

The increase probably will average 14 cents an hour for 292,000 production workers and 117,000 refinery workers. That alone will mean a cost of $120 million more per year. When the cost of similar increases to supervisors, field engineers, general office workers, and executives is added, the total will undoubtedly soar beyond the $200-million mark.

New Helium Plant Slated by Kerr-McGee

CONSTRUCTION of the nation's first privately financed helium-extraction plant will start soon at Pinta dome, Apache County, Arizona.

Kerr-McGee Oil Industries, Inc., Oklahoma City, will build the plant to process 2,500,000 cu. ft. of gas daily. Company engineers estimate recoverable reserves of pure helium at 600,000,000 cu. ft.

Cost of the plant and facilities is figured at $2 million. Operations will begin about Sept 1. Design and engineering work is being handled by Air Products, Inc., Allentown, Pa.

Bulk of the plant's production will be shipped by truck and rail and marketed to commercial sources on the West Coast. The project has no connection with the federal Government's new helium-conservation program.

Under new federal legislation, the Government may contract to buy crude helium from plants to be financed, built, and operated by private industry.

BRIEFS . . .

miles of 6 to 12-in. sales laterals. Expansion plans also call for installing 25,000 hp. in compressor capacity.

Completion of a 4,500-hp. compressor station near Rawlins, Wyo., has boosted delivery capacity of Colorado Interstate's Wyoming transmission line by 50 million cubic feet daily to a total of 188 million cubic feet daily.

Two gathering systems comprising the Williston Basin Pipe Line Co. started operating in December. One system serves North Dakota's Rival and Lignite fields; the other serves the Renville and Bottineau County area. The 22-mile Rival-Lignite system's initial capacity of 5,000 bbl. daily is scheduled to be doubled this year. The Glenburn system is 10 miles long and has a capacity of 3,500 bbl. daily.

Permission to build a 16-in. line from Alberta's Savanna Creek field to a planned processing plant near Coleman is being sought by Saratoga Processing Co. Westcoast Transmission Co. intends to build the plant, which would process the sour Savanna gas and furnish the residue gas for a line that Alberta Gas Trunk Line is building to supply U. S. markets.

Ten million cubic feet of gas daily will be delivered to a new paper mill under construction near Snowflake, Ariz. Southern Union Gas Co. and El Paso Natural Gas Co. will build a 60-mile line to the Southwest Forest Industries, Inc., plant from El Paso's main line near Holbrook, Ariz.

Also for Pipeliners . . .

IN THE NEWS: New products pipeline from Linden, N. J., to Idlewild and LaGuardia airports in New York being studied (p. 51) . . . TGT seeks FPC permit for proposed gas line from Texas through northern Mexico into California (p. 52) . . . FPC approves the Rock Springs project sought by Colorado Interstate and El Paso Natural (p. 52) . . . FPC will hold first hearings in Midland, Tex., on area-wide policy of pricing gas (p. 58) . . .

PLUS THESE TECHNICAL REPORTS: Real advances in pipe laying occurred in 1960 (p. 74) . . . How to get better lubrication (p. 104).

Refinery Runs Dip Slightly in Southwest

- Drop in November runs is slightly more than the national decrease. But southwestern refiners are still running at a higher rate of capacity.

REFINERY RUNS in the southwestern states eased off slightly in November.

The crude throughput declined only 0.6%. Runs totaled 3,283,754 bbl. daily compared with 3,303,274 bbl. daily in October. The October figure represented a 0.9% gain over the previous month.

Southwestern runs followed a trend similar to national refinery activity which declined 0.4% during the month. U. S. runs were 7,902,000 bbl. daily for the month compared with 7,905,000 bbl. daily in October.

On a capacity comparison, southwestern refiners operated their plants closer to top ratings. In November runs in the 5-state area of Arkansas, Louisiana, Mississippi, Oklahoma, and Texas were 85.4% of capacity. They were 85.9% in October. The national runs represented 80.7% of U. S. capacity compared with 80.8% of capacity the month before.

Only Mississippi and Texas refiners recorded gains in crude runs for November in the southwest, and they were slight. Mississippi's November runs were 21,919 bbl. daily compared with 21,773 bbl. the month before. This was a percentage gain of 0.7%.

Texas refiners had an identical percentage gain. They ran 2,184,347 bbl. daily in November.

Louisiana had the biggest percentage drop. Runs were down 4.9% from October. Arkansas was down 2.5% and Oklahoma 1.8%.

ARKANSAS

(Refinery Runs in Barrels Daily)

Company and location—	November	October	November 1959
Amoco, El Dorado	30,973	32,033	*6,992
Lion, El Dorado	32,680	33,618	31,588
Macmillan, Norphlet	3,880	3,883	3,143
Other	5,846	5,725	6,335
Total Arkansas	73,379	75,259	48,058

*On strike part of month.

LOUISIANA

(Refinery Runs in Barrels Daily)

Company and location—	November	October	November 1959
Cities Service, Lake Charles	165,065	165,018	175,098
Continental, Lake Charles	51,315	51,598	56,178
Humble, Baton Rouge	273,167	294,950	329,343
Ingram, Meraux	15,829	17,417	19,251
Shell, Norco	98,288	102,684	101,492
Tenn. Oil Ref., Chalmette	42,114	40,876	25,140
Other	8,043	8,151	9,108
Total Louisiana	653,821	680,694	715,610

MISSISSIPPI

(Refinery Runs in Barrels Daily)

Company and location—	November	October	November 1959
Paluxy, Yazoo City	1,634	1,679	162
Pontiac, Hattiesburg	16,148	16,123	17,457
Southland, Sandersville	4,137	3,971	4,334
Total Mississippi	21,919	21,773	22,553

OKLAHOMA

(Refinery Runs in Barrels Daily)

Company and location—	November	October	November 1959
Allied, Stroud	1,438	2,028	2,661
Anderson-Prich., Cyril	10,883	8,689	10,212
Bell, Grandfield	6,400	6,371	6,351
Ben Franklin, Ardmore	11,590	11,512	10,006
Champlin, Enid	26,554	25,566	27,513
Cities Service, Ponca City	31,092	29,077	31,046
Continental, Ponca City	61,662	67,409	72,037
DX Sunray:			
Duncan	40,697	40,525	38,911
Tulsa	68,763	71,502	70,406
Kerr-McGee:			
Cushing	17,973	17,752	22,546
Wynnewood	18,038	17,288	18,111
Midland Co-op., Cushing	13,040	12,975	13,453
Phillips, Okmulgee	14,038	13,073	15,346
Texaco, West Tulsa	28,120	33,097	39,046
Total Oklahoma	350,288	356,864	390,037

TEXAS

(Refinery Runs in Barrels Daily)

Company and location—	November	October	November 1959
Amoco, Texas City	109,941	122,032	89,010
Am. Petrofina:			
Mount Pleasant	13,278	13,719	13,956
Wichita Falls	6,059	7,079	8,006
Atlantic, Port Arthur	63,785	68,732	65,456
Col-Tex., Colorado City	7,701	7,661	12,596
Continental, Wichita Falls	6,770	12,703	5,577
Cosden, Big Spring	28,650	25,005	28,422
Crown Cent., Houston	33,601	34,596	33,552
Delhi-Taylor, Corpus Christi	40,706	38,804	30,962
Delhi & Mayfair, Port Isabel	5,512	1,459	7,480
Eddy, Houston	2,110	1,972	2,017
El Paso, Odessa	12,664	12,219	10,704
Gulf, Port Arthur	277,158	270,375	233,142
Humble, Baytown	266,774	273,675	303,335
La Gloria, Tyler	16,361	16,382	15,419
Mobil, Beaumont	196,294	195,454	178,419
Phillips:			
Phillips	55,050	54,826	63,412
Sweeny	60,842	55,534	68,934
Pontiac, Corpus Christi	47,918	47,093	46,805
Premier:			
Baird	3,197	2,965	2,070
Fort Worth	5,555	7,484	7,655
Longview	3,355	4,358	4,531
Pure, Nederland	72,513	71,946	74,829
Republic, Texas City	24,033	21,911	27,216
Shamrock, Sunray	20,451	24,620	22,085
Shell, Houston	100,197	106,073	105,412
Signal, Houston	49,399	49,498	52,142
Sinclair:			
Corpus Christi	27,966	28,085	30,079
Houston	122,221	108,138	122,886
Skelly, Longview	2,231	3,058	2,023
Southwestern, Corpus Christi	29,147	25,334	37,626
Stand. Tex., El Paso	44,196	46,068	51,315
Suntide, Corpus Christi	39,703	39,027	42,042
Texaco:			
Amarillo	14,981	13,341	14,032
El Paso	9,869	1,466	11,529
Port Arthur	265,867	261,293	248,772
Port Neches	41,688	40,838	36,444
Texas City, Texas City	29,516	28,564	24,906
Other	27,088	25,297	22,521
Total Texas	2,184,347	2,168,684	2,157,319

brass tacks

FROM HALLIBURTON

Vis-O-Frac helps extend field

HydraJet helps prevent water problem

MCA plus Acidgel Frac equals profit

Another dry hole turns producer after Sandoil

FRACTURING FACTS

In the McComb, Mississippi field, a step-out well appeared to define the limits of the producing structure (Tuscaloosa Sand). Halliburton suggested treating a 10 foot interval at 11,000 ft. with 30,000 gal. Vis-O-Frac containing 1,500 lbs. FL-2 (fluid loss additive) and 40,000 lbs. sand. After treatment, the well flowed 145 BOPD, thus extending the field.

In a section of Cleveland County, Oklahoma, wells completed in the Tulip Creek formation normally produce large percentages of water. By perforating one of these wells through a one foot interval at 7,500 ft. with Halliburton's Hydra-Jet, and then placing 2,000 gallons Sandoil, carrying 2,000 lbs. sand, at a slow injection rate, the well flowed its allowable of *water-free* oil, even though it is surrounded by pumpers with a high water-oil ratio!

Before plugging this Mississippi lime well in Barber County, Kansas, a 500 gallon MCA treatment showed indications of gas. Halliburton then designed a 25,000 gallon, 7½% Acidgel Frac treatment with 20,000 lbs. 20-40, and 10,000 lbs. 10-20 sand for 35 BPM injection. After the fluid was recovered, production was 12,800 MCF gas per day!

Tests of this Mesa Verde well in Sweetwater County, Wyoming were inconclusive, but pointed to a dry hole. The operator decided to fracture the well with a 36,000 gallon Halliburton Sandoil treatment using #2 diesel oil with Hyflo and FL-2, and carrying 28,000 lbs. sand. His reward — a 480 BOPD producer, still flowing 170 BOPD through a 24/64" choke after four months!

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FPC Launching Gas-Rate Hearings at Midland

• The kickoff conference in a series of area-wide studies on price guides laid down by the commission will be watched closely by the industry. Clues to future handling of the area-price approach may come from the Texas meet.

THE Federal Power Commission has set the stage for the first of a series of area-wide hearings on natural-gas rates.

The initial step will be a prehearing conference March 6 at Midland, Tex., for producers in the Permian basin area of southeastern New Mexico and two nearby districts in southwestern Texas—Districts 7C and 8.

The purpose of the conference and the hearing will be to determine whether adjustments are needed in preliminary price guidelines set by the FPC in its original area-pricing policy statement issued September 28.

FPC said a similar rate hearing for southern Louisiana is also being planned for "the near future."

The Midland prehearing conference will be watched with keen interest because it will indicate the pattern the commission will seek to establish for reviewing or revising area prices.

Also, it very likely may lead to a specific court test of the area-pricing approach.

The FPC's chief examiner, Edward B. Marsh, will preside at the Midland conference.

The aim will be to expedite the hearing itself by seeking to spell out the types of evidence to be presented in such hearings, issues to be discussed, and the category of witnesses who will be eligible to participate.

Producers have been urging the FPC to specify what type of procedure would be required to obtain a hike in an area-pricing ceiling.

After the conference, Marsh will make recommendations to the commission on rules and procedures he thinks should be adopted for the actual hearings.

Participants . . . About 350 producers will be involved in the conference. Included will be all producers in the designated area with pending rate-suspension cases not yet set for hearing. Any new rate-suspension proceedings started before the conference begins will also be handled in the consolidated proceedings.

In addition to producers, pipeline companies purchasing in that area, distributing companies affected, and even ultimate consumers will be granted representation.

The FPC said, however, that because of the large number of interested parties, unlimited individual participation would not be permitted. Therefore, the FPC is advising interested parties to specify in advance their interest in the proceedings and why they feel they are entitled to participate.

One apparent aim of the prehearing conference will be to consolidate groups so that individual firms will not need to participate in the hearing itself. Otherwise, a hearing might go on indefinitely.

Restrictions . . . The commission specified that the hearing will not include any proposals for changes in area boundaries or in prices for other areas.

FPC officials previously had indicated that they hoped eventually to shift area boundaries to conform more realistically to geological areas rather than to geographical areas. However, the FPC evidently decided not to go into that problem now.

Prices . . . Currently, the price guides for the areas to be covered by the hearing are 16 cents per M.c.f. for initial rates and 11 cents for increases under old contracts.

At the hearing, FPC will consider evidence that either or both of these ceilings is too low, too high, or about right.

Areas affected . . . In New Mexico, the area included in the hearing is in Chaves, Eddy and Lea counties. In Texas, District 8 covers 41 counties in the southwestern corner of Texas, partly adjoining the New Mexico Permian basin area. District 7C includes 12 counties east of the southeastern boundary of District 8.

Mississippi Orders First 80-Acre Spacing

A PRECEDENT-SETTING order by Mississippi's State Oil and Gas Board puts into effect an 80-acre spacing for drilling oil wells in the state's relatively new McElveen field.

The regulatory body acted on the unopposed claim of operators in the field that the state's present 40-acre maximum spacing would be uneconomical at McElveen. The board's decision was unanimous.

Although the new order applies only to the one field, it opens the way for possible adoption of wider spacing in other new fields.

R. M. Hearin, Jackson banker and president of the Mississippi-Alabama Division, Mid-Continent Oil and Gas Association, said the new spacing order is "the most progressive conservation step in Mississippi since enactment of the Conservation Act of 1948."

Other oil-industry leaders in Mississippi viewed it as a stimulating factor in exploration and development in the state. It also is expected to effect major savings by eliminating many unnecessary wells in a field with prospects of low per-acre oil recovery and return.

McElveen, in eastern Amite County, is one of a succession of deep fields opened in recent years. Oil production comes from lower

Tuscaloosa stringer sands at 10,500 to below 11,000 ft.

Its discovery well, drilled by Justiss-Mears Oil Co. and others on a farmout from Pan American Petroleum Corp., was completed last July with a daily flow of 240 bbl. through 9/64-in. choke. A northeast diagonal offset has been completed, two others are in process of completion, and two more are drilling.

The 80-acre spacing is expected to insure more profitable operation at McElveen than at the large McComb field, 3 miles northeast, developed on 40-acre spacing.

McComb, scene of one of Mississippi's most active drilling plays during 1960, now has more than 120 wells. Its lower Tuscaloosa stringer sands have an average thickness of approximately 15 ft. But because of high connate water saturation and fairly low porosity, they are estimated to have a low per-acre-foot ultimate recovery.

Under these high-cost conditions, plus sharp pressure declines in the reservoir, McComb has not proved too attractive economically.

Nebraska approves Skelly request for 80-acre oil spacing

FIRST 80-ACRE SPACING in Nebraska has been ordered for the Culbertson (South Culbertson) field of Hitchcock County.

The Nebraska Oil and Gas Commission issued the order at the request of Skelly Oil Co.

There is one well in the seven-section field, Excelsior & Volentine's Schaffert No. 1 in NE NE 4-2n-31w. The well came in Aug. 24 for an initial flow of 192 bbl. daily of 31.5°-gravity oil. It produces from the Lansing-Kansas City formation at 3,765-3,861 ft.

Skelly has started a second well to test the formation in SW SW 34-3n-31w.

Nebraska has had state-wide 40-acre spacing since its Oil and Gas Commission was organized in September 1959. Last November the commission denied application of Pubco Petroleum Co., Denver, for 80-acre spacing in the Lansing-Kansas City reservoir of Sleepy Hollow field, Red Willow County.

watching WASHINGTON

Clyde La Motte

• Who will be calling oil signals in Washington? . . .

APPOINTMENTS being made by President-Elect Kennedy are now nearing the level of positions that deal directly with oil.

Washington oil observers have a growing feeling of uneasiness at the trend that seems to be developing.

For instance, there was the appointment of Walter W. Heller to be chairman of the Council of Economic Advisers. Heller, a University of Minnesota economist, has in the past spoken out bluntly against oil's percentage depletion.

James M. Landis, who is playing a big hand in proposals to overhaul regulatory agencies, seems to have cocked a skeptical eye at the industry.

Landis has already submitted a report to Kennedy, and one underlying theme was that the Federal Power Commission has been "soft" in its regulation of producers.

Since Landis will no doubt have a voice in selecting new members for the FPC and other regulatory agencies, it is logical to suppose that he would prefer appointees with views somewhat akin to his own.

Sen. Estes Kefauver (D., Tenn.), no big friend of oil, also may swing considerable influence in appointments to regulatory posts.

Speculation that Rep. James Roosevelt (D., Calif.), might be appointed Federal Trade Commission chairman was still being circulated around Washington early last week. But whether it is Roosevelt or someone else, chances are it may be someone from the Roosevelt school of thought concerning oil.

• Shape of new oil policies is still indefinite . . .

THE TREND of appointments does not mean that Kennedy is deliberately launching an anti-oil campaign. There is no indication that this is the case at all.

But it stands to reason that if a considerable number of key advisory and regulatory personnel chosen by the incoming President have the conception that the oil and gas industry is too big, too powerful, or too rich, the industry is in for tougher sledding.

Aside from appointees who may be biased against oil, there will be many who have very little first-hand knowledge of the industry or of its problems.

• This time oil may be better prepared than usual . . .

THE SWITCH in administrations comes at a time when the industry had seemingly been making some headway in getting its story across in Washington.

Now a great deal of that work probably will have to be done again.

Perhaps this is not a bad thing. It should tend to reemphasize to industry leaders the continuing need to maintain good representation in Washington.

In recent years, many individual companies and associations have beefed up their Washington operations.

There already has been evidence that this has obtained some good results. And developments during the new administration may prove more than ever the wisdom of such a move.

This will be particularly true if, as suspected, the Kennedy Administration does some looking before it leaps to new oil policies.

another
TRETOLITE SERVICE
report

Squeeze Treatment Doubles Oil and Gas Production

The treatment of nine wells on a Texas lease was simple, effective and low in cost—about $300 to $350 per well for TRET-O-LITE demulsifying chemical, pressure pumping truck, and vacuum tank truck. Most of the wells were completed through tubing, with packers set above perforations. Several were dual completions, with two strings of tubing and producing zones separated by packers.

How Tret-O-Lite Chemical Demulsifier was used*

Thirty gallons of TRET-O-LITE demulsifying chemicals were mixed with sixty barrels of lease crude (40° API). This mixture was pumped into tubing of each well, followed by enough crude to allow about 300 feet of oil-chemical mixture to stand in tubing. Each well was then shut in for 18 to 24 hours.

Pays for itself in two days

The figures in the table show how effectively the TRET-O-LITE squeeze treatment increases production in the nine wells.

The increase in production was sufficient to pay for the cost of the total squeeze job in about two days.

WELL	DEPTH	MAXIMUM INJECTION PRESSURE	PRODUCTION BEFORE SQUEEZE		PRODUCTION AFTER SQUEEZE		GAIN BBLS. DAY
			BBLS. OIL / DAY	MCF GAS / DAY	BBLS. OIL / DAY	MCF GAS / DAY	
1	9642	4800	34	153	61	593	27
2	8381	3000	30	5	52	83	22
3	9640	3600	35	224	87	323	52
4	9625	4500	40	672	50	497	10
5	8484	3700	27	339	51	700	24
6	9652	3000	53	35	83	353	30
7	8397	5200	30	32	125	238	95
8	8408	3800	15	12	129	94	114
9	9310	3600	0	0	123	760	123
		TOTAL	264	1472	761	3641	497

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BLEAK SANDS of the oil-rich Libyan Desert show only two signs of civilization—tire tracks and several joints of pipe.

Libya to Date: More Problems Than Oil

• Highly nationalistic officials are spinning a web of red tape which hampers oil operations. An enlightened government would make petroleum prospects in the new oil country even brighter than they are now.

Paul Swain
International Editor

LIBYA, the world's hottest oil country today, is suffering growing pains that make the physical and mental agonies of a pimply-faced adolescent look mild.

Too much has come to Libya too quickly.

Ironically, the Libyans themselves feel the reverse is true. With the smell of oil in their nostrils and with visions of wealth like that enjoyed by some of their Arab brothers in the Middle East, Libyans are impatient.

It is getting to be more difficult for an oil company to operate in Libya. It probably will get worse before it gets better. If Libya is to have a smoothly operating, efficient oil industry that will benefit both the country and privately invested capital, it is going to take a great deal of wisdom on the part of Libyans. It is going to require patience by the industry while the Libyans gain that wisdom.

Too many Libyans, both in high places and in Tripoli's sidewalk cafes, think of Libyan oil in terms of millions of barrels a day. There is little doubt that Libya is going to produce a lot of oil, but the day its output can be counted in the millions is not going to be tomorrow.

With the first flush of exploration successes, far too many irresponsible people have compared Libya to the Middle East. They've made believers of the Libyans, all of whom are eager to get the benefits of this oil money. There are indications that some of them aren't content to wait for the normal flow of oil income that will come with sensible, efficient, and orderly production.

Libya is a new country. Before the first oil was discovered in the North African desert less than 2 years ago, it had little in the way of national assets. Behind it was a long history of foreign domination. Its present was overshadowed by extreme poverty, very little economic stability without outside aid, and a very uncertain future.

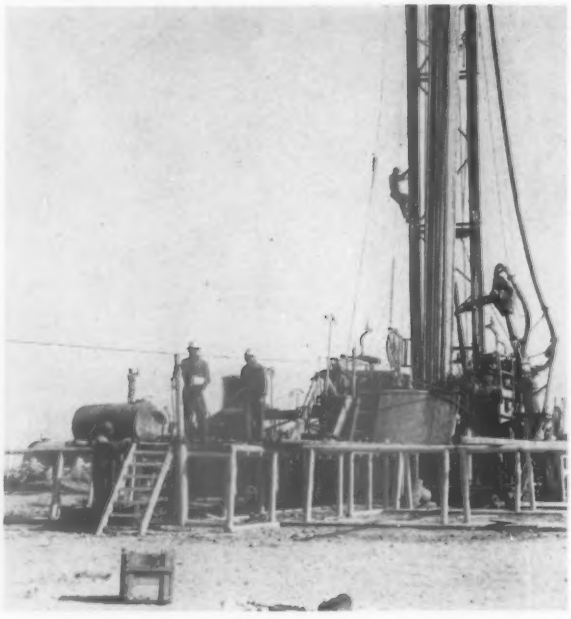
Then in 1956 oil exploration began in Libya. The 19 companies now operating in Libya have poured about $370 million into the country since that time. The heady influx of capital in large amounts has had mixed blessings for Libya.

Libya's officials, like those in all newly independent nations over the world, are highly nationalistic. Most of them have only a limited understanding of how the oil industry operates or why it does things the way it does. As longtime colonials, Libyans are inclined to regard the things foreigners do with a certain amount of distrust.

In their well-meaning zeal to protect the interests of the country and insure for Libyans the most from the country's oil potential, these officials are creating a strangling web of governmental red tape. From a practical standpoint much of this additional routine and regulation only serves to delay the day when oil income will actually start to come in—the one thing the Libyans are most eager to see happen.

The fledgling oil industry in Libya, dominated by American companies, is caught squarely in the middle. The industry is beset by

THIS IS HOME for oil workers in Libyan field . . .



. . . **AND RIG WORK** is not easy in the arid land.

new operating problems nearly every day.

Work permits, which companies feel should be issued as a matter of course, are extremely hard to get. The formal registration of a company under Libyan law—a necessity—once took only the amount of time needed for the mechanics of the legal registration and filing the necessary documents and papers. Now it takes months.

There is every indication that these government-imposed problems are going to become more complicated. The 18 or more oil companies eager to enter the Libyan oil play are going to have it tougher than the companies already there.

Many of these companies have had representatives in Libya for months awaiting the end of 1960 when the veteran companies begin to surrender 25% of their concessions at the end of initial 5-year terms. Few of them have even been able to get local companies registered.

"I've finally come to the conclusion that one reason we get so little action is that everyone is afraid to take any action," one frustrated American company representative says wearily.

"The people in government who should be acting on these matters we regard as routine are afraid they'll do something wrong and will be criticized for it.

"They don't have many precedents to guide them and few are willing to try anything new."

New decree . . . Typical of what can be expected in the future is the recent "communique" published in Tripoli by Abdulkadr el Badria, the new minister of national economy.

Badria served notice on oil companies that in the future they will have to give "first preference" to drilling and contracting companies with Libyan partners or Libyan capital.

His statement didn't mention that Libyan capital is almost nonexistent. The available supply of potential—even eager—Libyan partners is almost limitless. Their value to a business partnership is another question.

The minister explained his action by complaining that Libya's "ideal" of having foreign capital and technical knowledge "blended" with Libyan capital and participation has not been achieved as the government expected.

His statement of policy for the future carries this ambition even further. He said flatly that no foreign drilling or technical contracting company will be allowed to work for oil companies unless it can produce documents proving the company has a definite need for its services.

He added that companies with Libyan partners will be given preference in the future when permits for field operations are handed out.

He concluded by saying that any companies which would like to work in Libya "should feel obliged to observe this policy which would benefit both parties."

Who is "capable"? . . . At about the time this policy was outlined, Mohammed ben Otman el Seid, the country's new prime minister disclosed he is working on a new 5-year plan which he expects to give Libya "security and confidence."

The prime minister made it plain that the oil industry will be expected to contribute to this new plan. He said the government will encourage, protect, and help oil companies so they can work confidently and in peace.

"We are also keen to give opportunities to Libyan elements to work with the oil companies and we will not permit any oil company to deal with foreign sources or persons except in the exceptional cases where Libyan capabilities cannot be found."

The key to that issue is Libyan "capabilities." Not many oil companies would agree with the prime minister that the need to deal with foreign sources and personnel is the exceptional case.

The industry now employs more than 6,300 Libyans in its opera-

tions. Another 750 are local, but non-Libyan, employes. The expatriates in the oil industry number about 2,100. The great bulk of the Libyans are hired as common laborers. Few are qualified to perform any other oil field duties.

Libya's brief oil industry . . . Since the first exploration concessions were granted just 5 years ago, 18 of the 19 companies operating in the country have drilled 130 wells, found about 40 producers and established at least 11 oil fields.

This success ratio makes Libya unique in the world's oil country today.

Total output on tests of the wells completed so far is more than 85,000 bbl. daily. In spite of the intensive work that has been done, Libya's surface is barely scratched. Development drilling for fields that have been established is barely under way.

Libya's oil future . . . With this intensive early exploration already behind it, and dozens of new companies clamoring to take part in the country's future development, Libya's oil future can be little except bright.

The single factor that would give Libya's infant oil industry the stability and driving force it needs to really benefit the country is an enlightened government and fewer bureaucratic roadblocks.

Most oil men in the country who have to deal with governmental problems are frustrated by most of them, but at least a few are philosophical about it all.

"These people are proud, nationalistic, and not very experienced in governing themselves," one says resignedly.

"They are still feeling their way, but a few of them want to run before they have learned to walk well.

"They are getting a lot of advice from a lot of quarters and not all of it is good (with a gesture to the east in the direction of Abdel Gamal Nasser's Cairo capital and its powerful propaganda radio).

"A lot of these things are going to work out in time. They have to. Otherwise we're pouring an awful lot of money into an oil industry for this country that is going to be wasted."

Italy-India Oil Talks Snagged

. . . on profit-split issue. Indians insist on getting the lion's share, so chances of a pact with ENI are slim.

ITALY'S ENRICO MATTEI is dangling a $100-to-$200-million oil-development offer in front of India, but the Indian Government is holding out for terms that would be startlingly one-sided.

Mattei, head of the Italian state oil agency, reportedly offered to invest from 500 million to a billion rupees in the Indian oil industry in the latter country's 5-year plan. The investment would cover exploration, production, marketing, and petrochemical projects. A rupee is worth about 21 cents.

The talks were inconclusive. While an Italian-Indian deal still may be forthcoming, it may be significant that Mattei failed to come up with a major agreement in an important country after his quick business trip.

The proposed exploration phase of the agreement is comparable to those made by ENI in Iran and other countries. This calls for the formation of a joint ENI-government company in which each will have 50% participation. Presumably, as in other agreements, India would not have to put up any capital until commercial production is proved.

Profits would be split first by the joint company, and then with the government. This would, in effect, give the large slice of a 75-25 profit split to the government.

India will go along with the joint company. But it is dickering for more than 50% of the profit on the second go-round. Its view is that its share should be 60%, the revenue it says it is entitled to under existing tax laws.

Reports from New Delhi also indicate Mattei's terms for collaboration in production and marketing did not impress government negotiators as being much better than those offered by private companies.

Mattei also offered credit with which India could import oil-field and refinery equipment from Italy, and pay for technical services. This in particular would cover engineering work for workshop facilities, transport, and petrochemical plants.

ENI is believed to want exploration rights in Kutch, in Gujarat State, and in the Gangetic Plain.

Refining policy . . . Government policy may preclude any ENI refining or marketing agreement.

India plans to limit any further expansion in this side of the industry to government ownership whenever possible, unless it considers offers by private firms exceptionally favorable. It expects to turn down an application by Burmah-Shell to expand its 50,000-bbl. Bombay refinery. And Esso Standard Eastern, which will inherit Stanvac's Indian facilities after a corporate break-up, may have tough bargaining for its expansion plans at the 38,000-bbl. Bombay refinery. Esso also wants to set up a lubricating-oil plant in partnership with the government.

These plans are tied in with an application for exploration rights in Northwest India, across the border from a Stanvac natural-gas discovery in West Pakistan.

New Delhi observers believe the government may be holding out on the expansion permits in order to secure better terms on imports. They say that if Burmah-Shell and Esso agree to use indigenous crude, or crude from any other source available to the government on more advantageous terms than those of company sources, permission for expansion may be granted. The "other source" undoubtedly is Russia.

Concession seekers . . . A half-dozen foreign companies have made exploration offers to the government.

Three of them, Continental Oil Co., American Export Co., and Texfel, reportedly have indicated they are interested in exploration only, and are not seeking tie-in agreements for other operations. The government is said to be considering a 50-50 profit on crude output as acceptable, depending on how the net is arrived at and what allowances and expenditures are claimed for operations.

New Triumph for Tariki—He's Oil Minister

• Elevation of the shrewd nationalist to cabinet rank puts him closer to realization of his greatest hope—full Arab control of Middle East oil.

IT TOOK a bloodless palace revolution to do it, but Saudi Arabia's oil affairs are now in the hands of a government minister with cabinet rank.

When King Saud Ibn Abdul Aziz deposed his half-brother, Crown Prince Faisal, as active head of the Saudi Government last week, he named another cabinet. Among its members was a new minister of petroleum and mineral affairs, Abdullah Tariki.

It is ironic, but many observers of the Saudi scene have long regarded Prince Faisal as Tariki's mentor and primary supporter in the royal family. Now through Faisal's official fall from the most powerful spot in the Saudi Government, Tariki steps up.

The promotion for Tariki was also undoubtedly designed to give him added stature in Saudi dealings with the newly formed Organization of Petroleum Exporting Countries. Tariki has been a prime mover in setting up OPEC and his new ministerial rank will make him an even more powerful figure in the group.

The political background . . . The present Saudi king inherited the throne from his fabulous father, King Ibn Saud, the man who carved out a kingdom covering most of the Arabic Peninsula for the first time in modern history. After the old king's death in 1953, the younger King Saud ruled as an absolute monarch until March 1958. Then a change in the way the country was administered took shape. It was plain that despite oil revenues of more than $270 million, Saudi Arabia hovered on the brink of bankruptcy.

Few outsiders really know what goes on in the governmental palaces of the feudal kingdom, but reports at that time indicated Crown Prince Faisal persuaded other members of the huge royal family to bring pressure on the king to name him premier, minister of foreign affairs and defense, and minister of finance.

With these posts, Faisal had a firm grip on the purse strings. He instituted an austerity program, curbed the inflation that gripped the country's economy, and put the royal family on a budget. Before last week's ouster he had brought the country back to relative financial health. Meanwhile, his own health was deteriorating.

Abdullah Tariki
. . . nearer to his dream.

There have been periodic reports of policy clashes between the king and his ailing half-brother, but it was not until last week that the break came and the king took over the government again and named a new cabinet.

Tariki's position . . . Abdullah Tariki, a Bedouin tribesman's son who was educated at the University of Texas, is easily recognized throughout the oil-producing Arab world as that region's foremost oil expert.

A tenacious nationalist, the slightly built, graying oil minister first went to work for Arabian American Oil Co. as an engineer at Dhahran when he returned from the United States. He later became an employe of his own government in the formation of the Directorate of Petroleum and Mineral Affairs, and began to grow in stature.

He was one of the moving forces in the first Arab Petroleum Congress held in Cairo in 1959 and easily emerged as the most powerful Arab oil figure at the second Congress held in Beirut last October.

Long a bitter critic of the methods of the four American parent companies of big Aramco, Tariki was named a member of the Aramco board representing his government in the interval between the oil congresses.

He, along with Dr. Juan Pablo Perez Alfonzo, Venezuela's oil minister, has been a leading proponent of cooperation between the Middle East and Venezuela to force the operating oil companies to meet producer-country terms.

A congenial person, Tariki moves easily through any oil group.

But quiet reflection and smiling humor can change quickly to biting scorn when he talks about his feeling that the operating oil companies take advantage of Arabs in the conduct of their business.

Tariki has three major aims which he believes will give Arabs more benefits from the oil that lies below Middle East sands. They are:

. . . Complete integration of Aramco, making it a refining, transporting, and marketing oil company. He believes it is now a foreign-controlled producing company subject to the whims and caprices of its parent companies.

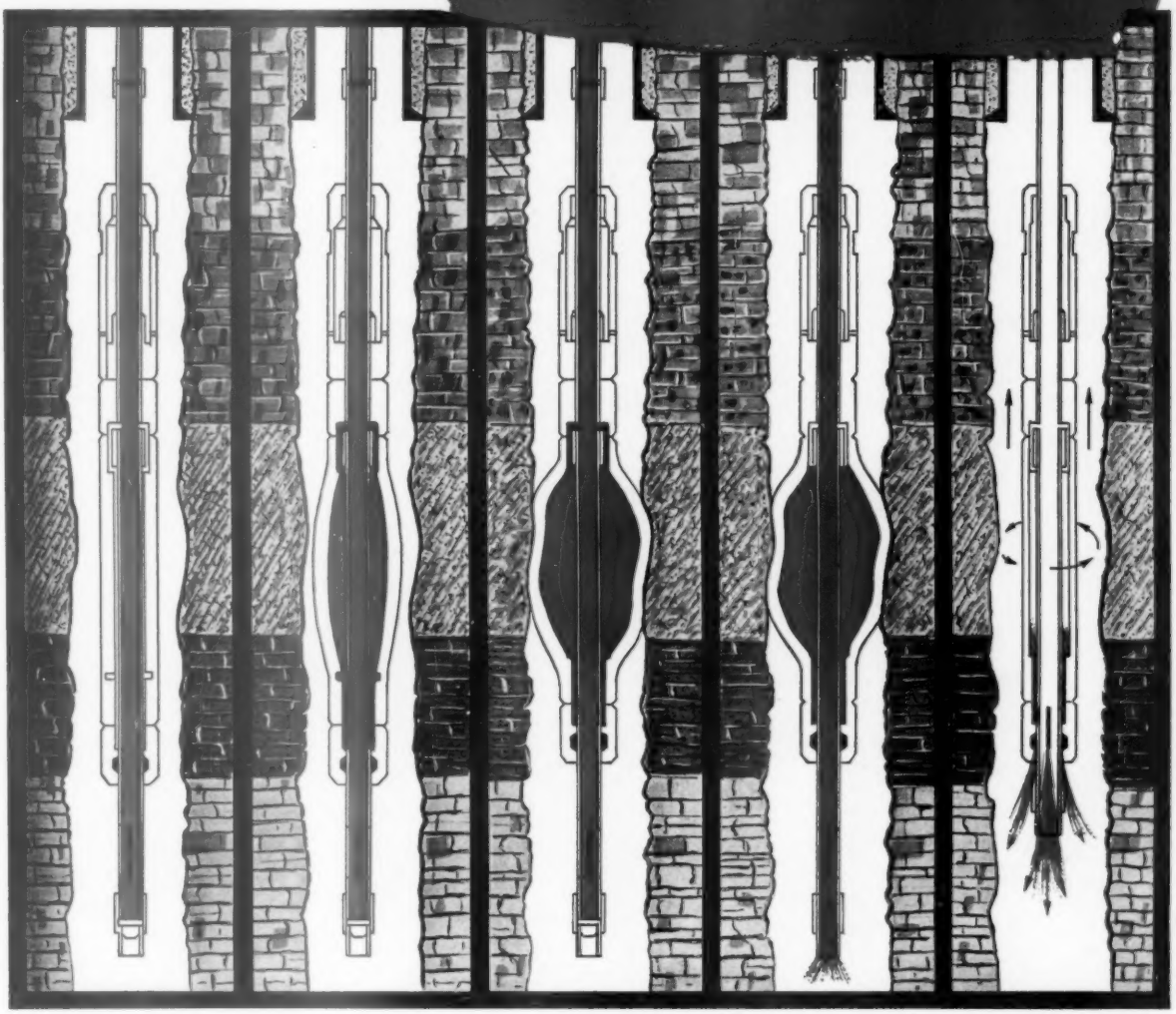
. . . A more active Arab role in all phases of the oil industry in the Middle East and throughout the world. Tariki feels that as the world's primary suppliers of oil, the Arabs should have more voice in the industry.

. . . Eventually, complete Arabization of Middle East oil. When he speaks of this, Tariki has a faraway gleam in his eye and says quietly that this must come. His remarks along this line have been widely interpreted as references to the day when present producing concessions expire in the Middle East.

With his elevation to full minister in the Saudi cabinet, Tariki appears to be moving closer to fulfillment of his dreams.

HOW LYNES "PIP" PACKER SEALS IN OPEN HOLE OR CASING

The simple, positive operation of the Lynes inflatable "PIP" packer makes every driller a packing expert. Setting is merely a matter of running the tool into the hole on tubing or drill pipe to the exact depth desired and pressuring up on the pumps. The steel reinforced rubberized sealing element expands up to twice its run-in diameter to effectively seal in open hole or in casing. The sealing element is 53 inches long.



Here's How It Works

Make up "PIP" Packer on tubing string with knock-out or rupture disk in bottom. Run to desired setting depth.

Fill string with fluid. Pressure-up on fluid.

Check valves in ports open under pressure and sealing element inflates. Check valves hold pressure in sealing element when pressure in string is released.

Sealing element grips bore or casing wall and will hold against high differentials from above or below without weight on string.

To open below packer, knock out disk with sinker bar or increase pump pressure to rupture disk.

To release packer, rotate string to right, pull up 1½ feet. Fluid escapes from inflated sealing element along grooves on mandrel. Wait 15 minutes and pull out of hole.

Packers for use in casing have "friction grip" elements with metallic particles imbedded in the rubber cover to produce high anchoring friction against the casing.

Available in sizes 3½" through 5⅝" to seal in holes up to 11".

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World Flow Hits Crest

• October crude production topped the free world's previous record, which was set only a month before.

FREE-WORLD crude production climbed to a record high in October.

Another round of Middle East gains broke the previous high mark, set in September. For the first time, Saudi Arabia went over 1.3 million barrels daily and Iran topped 1.2 million barrels.

Iraq's production was only a shade lower than its September record. Kuwait output slipped 50,900 bbl. daily, but its average stayed at well above 1.6 million barrels.

Middle Congo, on the West Coast of Africa, has joined the world's crude-producing countries. SPAFE, the French company which also operates Gabon's fields, opened Pointe Noire oil field in Middle Congo to commercial production earlier this year. Cumulative output through October reached 35,527 tons, or about 250,000 bbl. October production was 1,900 bbl. daily.

TREND OVER THE LAST YEAR

	Western Hemisphere less. U. S.	Middle East	Total free world outside U. S.
1959			
October	4,044.9	4,688.1	9,647.5
November	4,123.2	4,820.7	9,877.9
December	4,218.5	4,682.0	9,861.5
1960			
January	4,316.5	5,065.3	10,334.7
February	4,389.5	4,986.5	10,313.2
March	4,156.4	5,146.3	10,346.8
April	4,069.5	4,925.5	10,055.1
May	4,317.4	5,286.2	10,680.2
June	4,285.4	5,164.5	10,568.2
July	4,214.2	5,103.5	10,448.3
August	4,286.5	5,146.8	10,570.6
September	4,321.0	5,500.9	10,951.0
October	4,178.9	5,630.6	11,035.4

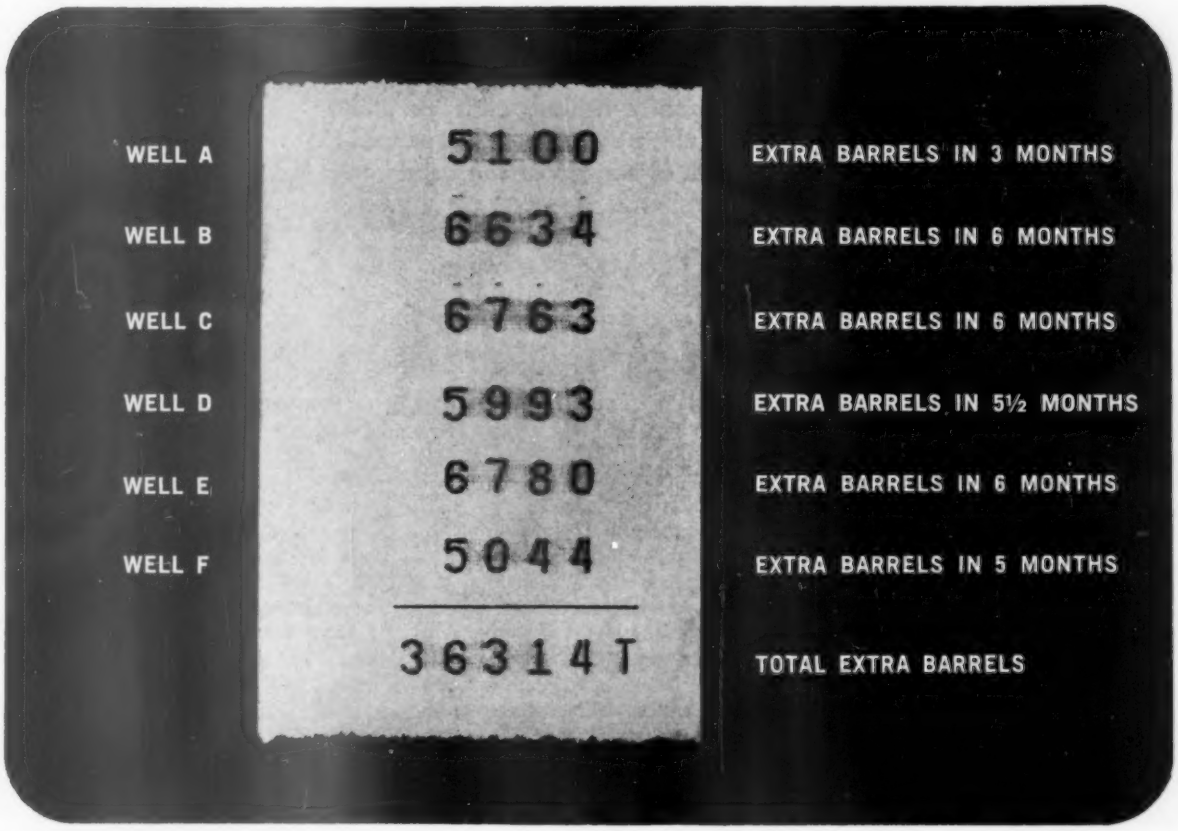
World-Wide Crude Production: Daily average in thousands of barrels

Country—	October 1960	Sept. 1960	October 1959
Western Hemisphere			
Argentina	195.0	192.0	126.2
Bolivia	9.2	9.0	8.7
Brazil	81.1	81.1	74.7
Canada	482.3	514.9	487.9
Chile	19.5	19.0	18.6
Colombia	115.8	111.4	152.3
Cuba	0.2	0.2	0.5
Ecuador	7.3	7.8	7.6
Mexico	284.1	284.1	259.4
Peru	52.0	52.2	48.3
Trinidad	121.7	121.3	114.2
Venezuela	2,810.7	2,928.0	2,746.5
Total	4,178.9	4,321.0	4,044.9
Europe			
Austria	45.1	45.1	46.1
France	40.8	41.1	34.3
West Germany	108.0	107.3	101.5
Italy	38.7	38.7	31.3
Netherlands	38.7	37.6	33.6
United Kingdom	1.7	1.7	1.9
Yugoslavia	33.0	33.0	12.1
Total	306.0	304.5	260.8
Middle East			
Bahrain	45.1	45.1	45.0
Iran*	1,208.0	1,112.0	948.0
Iraq†	1,045.9	1,046.8	915.8
Israel	2.7	2.7	2.0
Kuwait	1,678.2	1,729.1	1,411.8
Neutral Zone	135.0	135.0	118.6
Qatar	183.2	174.7	173.1
Saudi Arabia	1,326.1	1,249.1	1,066.2
Turkey	6.4	6.4	7.6
Total	5,630.6	5,500.9	4,688.1

Country—	October 1960	Sept. 1960	October 1959
Other Asia			
British Borneo	93.1	93.1	109.7
Burma	10.5	10.5	10.7
India	8.5	8.5	8.5
Indonesia	433.5	396.0	381.3
Japan	10.6	9.9	8.8
New Guinea	4.5	4.5	4.5
Pakistan	5.9	5.9	6.8
Total	566.6	528.4	530.3
Africa			
Algeria	253.5	195.1	28.1
Angola	1.0	1.0	1.2
Egypt	60.1	60.1	64.1
Gabon	15.5	16.8	14.8
Middle Congo	1.9	1.9	.....
Morocco	2.0	2.0	2.2
Nigeria	19.3	19.3	13.0
Total	353.3	296.2	123.4
Free World			
Foreign	11,035.4	10,951.0	9,647.5
United States	6,971.0	6,958.0	6,911.0
Total	18,006.4	17,909.0	16,558.5
Communist Countries in Soviet Orbit			
Romania	231.0	231.0	235.0
Russia	3,100.0	3,027.0	2,688.0
Other Communist	100.0	100.0	100.0
Total	3,431.0	3,358.0	3,023.0
WORLD TOTAL	**21,437.4**	**21,267.0**	**19,581.5**

Figures are from reliable industry reports or government sources. Estimates are made where complete reports are lacking. *Includes estimated 6,000 bbl. daily from Naft-i-Shah field not operated by Consortium companies. †Includes estimated 3,500 bbl. daily from Naft Khaneh field, operated by Iraq Government.

could you use production increases like these?



This operator got 36,314 barrels of extra oil from six wells within six months after they were fractured by Dowell. Total service costs for the six treatments averaged only $2931.79 per well. The extra oil produced during the first six months, as a result of fracturing, cost less than 49 cents per barrel. Additional production after the first six months will be almost clear profit.

All six wells, in Manitoba, Canada, were treated by Dowell at about the same time. All were given similar treatments in which 50,000 pounds of 20-40 mesh sand, at 2-3 pounds per gallon of lease oil, were injected into the pay zone at about 40 bpm. The production gain was determined for each well by comparing total production for equal periods immediately before and after treatment. Production periods were six months for three of the wells. Records for the other three wells covered 5½, 5 and 3 months, both before and after treatment.

Your production problem may be different from the one faced by this operator. The chances are good, however, that Dowell engineers can design a treating program to help you produce more oil at less cost per barrel.

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SERVICES FOR THE OIL INDUSTRY **DOWELL** DIVISION OF THE DOW CHEMICAL COMPANY

How to correct

Bed-thickness data

from directional wells

- **Electric logs from directionally drilled wells do not show the true thickness of the pay zones. Corrections must be made before isopach maps can be used for reserve evaluation.**
- **Here are some methods that you can use on your crooked-hole fields.**

BY BASIL V. SAVOY AND A. L. VALENTINE
Petroleum Engineers,
Union Pacific Railroad Co.

UNIT EQUITIES and reservoir calculations can be in serious error if corrections are not applied to data taken from directionally drilled holes. The problem is compounded if the beds are steeply dipping.

When isopach maps are to be prepared, the commonly used method is to correct each of the log measurements to a corresponding vertical thickness. Under these conditions it is easier to use vertical thicknesses than thicknesses perpendicular to the bedding plane. This is true because the areas planimetered represent dipping surfaces which are projected to a horizontal plane. This projection automatically corrects for bed dip.

Here's how it works. A simple example will show the reason for using the vertical thickness. The true volume of the block in Fig. 1 is 100 × 1,000 × 1,000, or 100,000,000 cu. ft. When the block is tilted at a 30° angle, the area planimetered would be 1,000 × 1,000 (cos 30°) = 1,000,000 (0.8660) = 866,000 sq. ft. This area multiplied by the thickness perpendicular to the surface would give a volume of only 86,600,000 cu. ft., rather than the true 100 000,000 cu. ft.

If the planimetered area is multiplied by the vertical thickness, 100/cos 30°, the computed volume is 1,000,000 (0 8660) × 100/0.8600 = 100,000,000 cu. ft., which is the correct value. In this illustration, the error introduced by using the thickness perpendicular to the bedding planes rather than vertical thickness is 13.4%.

How to Correct to Vertical Thickness

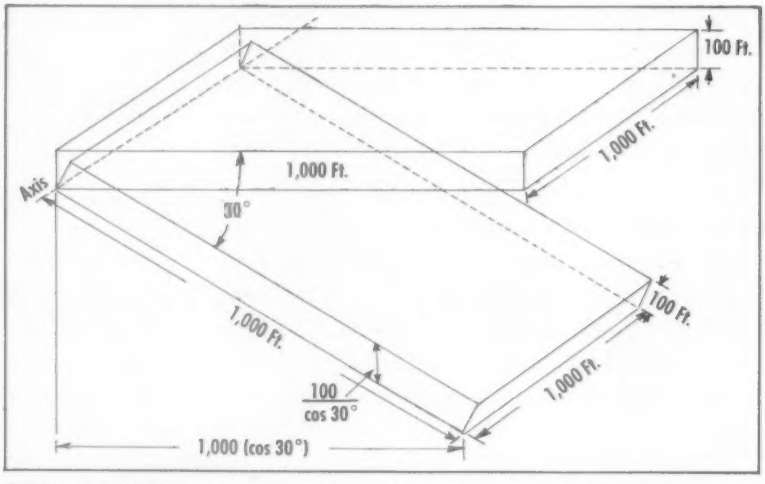
Vertical sand thickness may be found by multiplying the drilled sand thickness by a correction factor. A common method of finding this factor consists of a simple ratio of vertical to drilled measurements.

Fig. 2 shows a vertical cross-section through a producing formation. Two cases are shown; one where the well is drifting updip, and one where it is drifting downdip. It is assumed that point A is a good stratigraphic marker and that the drift angle through the formation is constant.

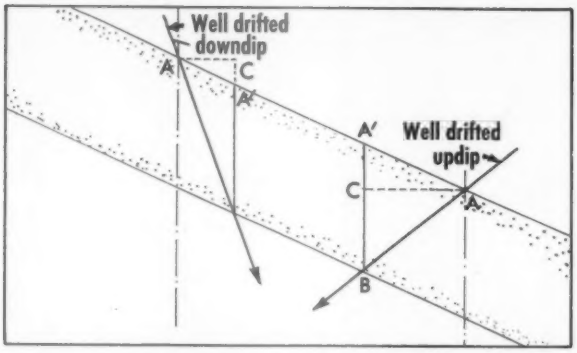
With these assumptions the correction factors may be found from Equations 1 and 2, and Fig. 2.

In making these calculations the drilled and vertical measurements are obtained from directional surveys. Structural differences, at the top of the horizon being planimetered, are obtained from a structural contour map.

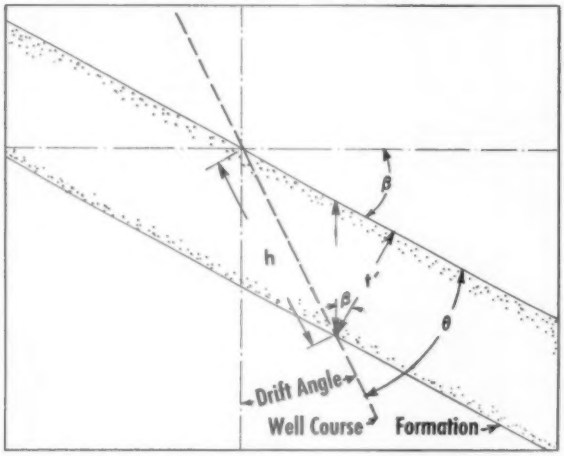
This method, though quite simple and fast under the proper conditions, has its limitations. For example, when the hole angle from A to B is not constant the drilled distance from the top to the bottom of the bed will be greater than for a constant-angle hole, yielding a factor that is too small. While this is not important in relatively thin formations, some error can be introduced in thick, massive sands, or



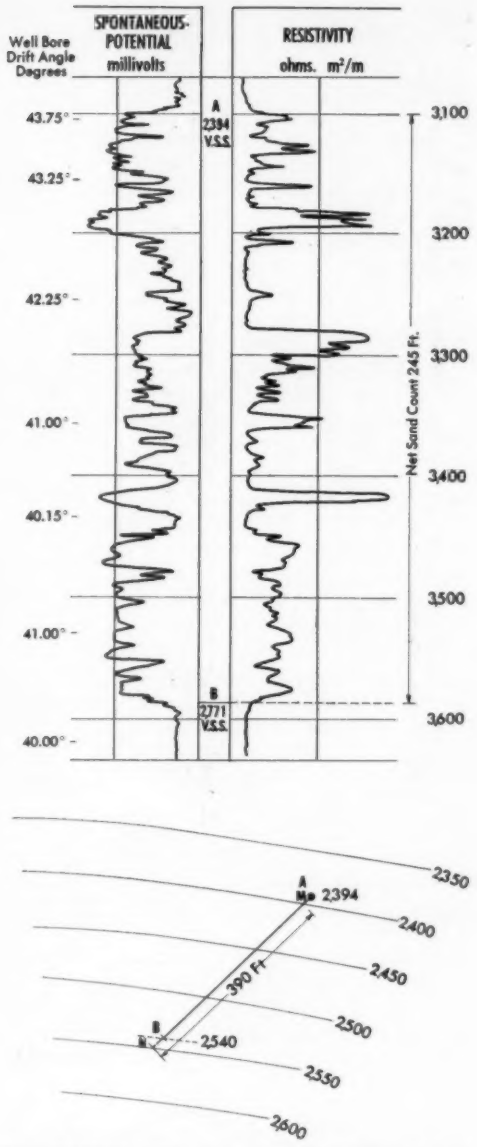
TILTING A BLOCK as shown here doesn't change its volume, but does change the projected area on a horizontal plane. Fig. 1.



DIFFERENT RELATIONSHIPS apply if the well drifts updip or downdip, as shown in Equations 1 and 2. Fig. 2.



THESE MEASUREMENTS and angular relationships are needed for finding a correction factor to be applied to isopach data. Fig. 3.



THIS ELECTRIC LOG of a productive interval and the trace of the well on a structure contour map are used in the numerical example presented in the text. Fig. 4.

where several sands are being handled as one.

Also, when the horizontal drift of the well bore through the formation is small (AC, Fig. 2), it becomes difficult to estimate accurately the structural difference at the top of the horizon being planimetered.

A more general method of solution uses the angular relationships between the well bore and formation.

Fig. 3 shows the measurements and angular relationships needed for finding the correction factor. The symbols in this figure are:

h = the drilled net sand thickness.
t' = the net sand thickness perpendicular to the bedding planes.
t = the vertical net sand thickness.
β = the apparent formation dip in the direction of the well bore.
Θ = the angle formed by the formation and the well bore.

This figure shows only the case

$$\text{Well Drifting Updip}\qquad \text{Correction Factor} = \frac{A'B}{AB} = \frac{\text{Vertical Difference (CB)} - \text{Structural Difference (CA')}}{\text{Drilled Difference (AB)}} \qquad (1)$$

$$\text{Well Drifting Downdip}\qquad \text{Correction Factor} = \frac{A'B}{AB} = \frac{\text{Vertical Difference (CB)} + \text{Structural Difference (CA')}}{\text{Drilled Difference (AB)}} \qquad (2)$$

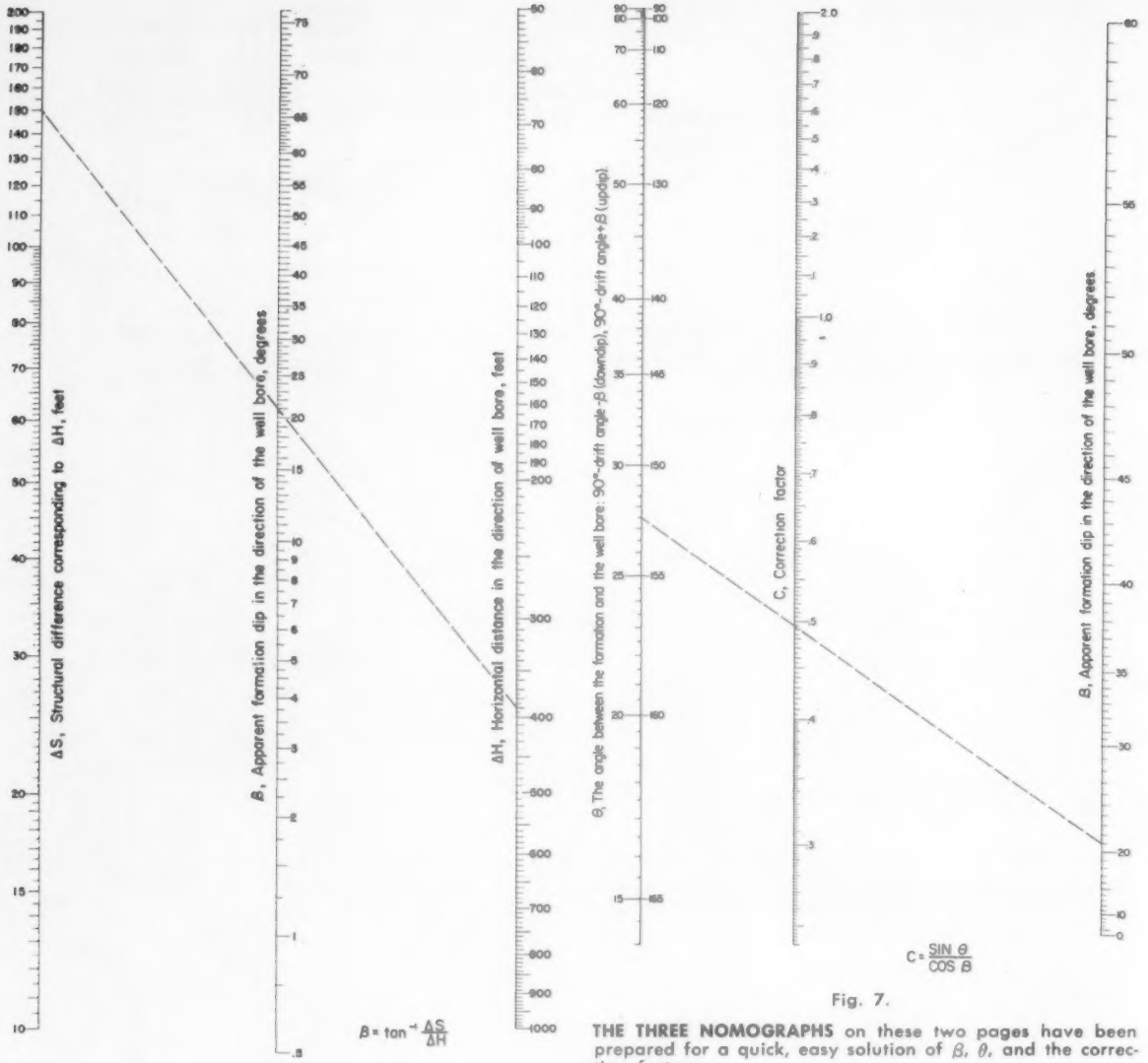

ΔS, Structural difference corresponding to ΔH, feet
β, Apparent formation dip in the direction of the well bore, degrees
ΔH, Horizontal distance in the direction of well bore, feet
θ, The angle between the formation and the well bore: 90°-drift angle-β (downdip), 90°-drift angle+β (updip)
C, Correction factor
β, Apparent formation dip in the direction of the well bore, degrees
β = tan⁻¹ ΔS/ΔH
C = SIN θ / COS θ

Fig. 5.

Fig. 7.

THE THREE NOMOGRAPHS on these two pages have been prepared for a quick, easy solution of β, θ, and the correction factor.

where the well drifts downstructure. The only variance in an up or downstructure solution is the angle Θ, which in each case would be:

$$\Theta \text{ (well drifts updip)} = 90° - \text{well-bore drift angle} + \beta \quad (3)$$

$$\Theta \text{ (well drifts downdip)} = 90° - \text{well-bore drift angle} - \beta \quad (4)$$

From Fig. 3 the following relationships can be written.

$$t' = h \sin \Theta \quad (5)$$

and

$$t = t'/\cos \beta \quad (6)$$

by substitution of (5) in (6)

$$t = h \sin \Theta/\cos \beta \quad (7)$$

assume h = 1 then:

$$\text{Correction factor} = \sin \Theta/\cos \beta \quad (8)$$

The well-bore drift angle can be found from the directional survey, and the apparent formation dip from a structural contour map.

The advantage offered by the latter method is that it is more accurate over a wider range of application. As will be shown in the sample calculation, a method of weighting a varying drift angle in a long interval yields an average angle that should improve the results. Finding the apparent formation dip from a structure contour map is made easier by using a well-course projection to two contours. The method also lends itself to a simple nomographic solution.

Procedure and examples. Data for the solutions are shown in Fig. 4—an electric log, directional survey data, and a structural contour map in the area of the subject well. The well is to be used in the preparation of an isopach map. A factor for correcting the drilled net sand thickness between points A and B, to vertical thickness is desired. Following are solutions for determining the correction factor by each of the two methods.

Solution by the Ratio Method

From the plan view in Fig. 4 the well is drifting downdip, and Equation 1 applies. Both the drilled and

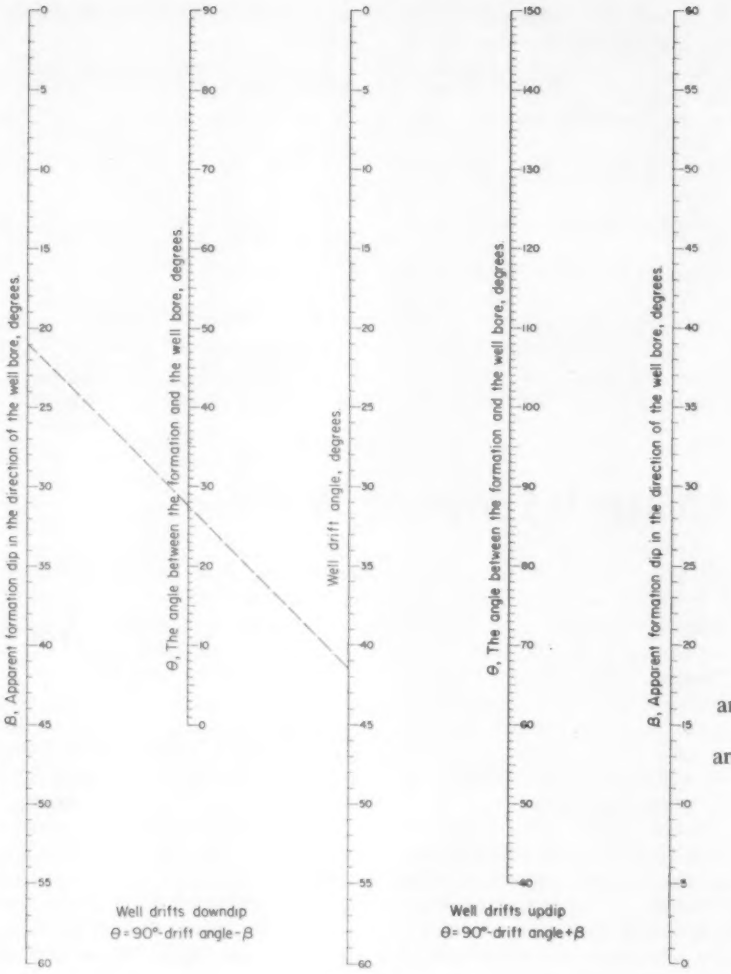

β, Apparent formation dip in the direction of the well bore, degrees.
θ, The angle between the formation and the well bore, degrees.
Well drift angle, degrees.
Well drifts downdip
θ = 90°-drift angle-β
θ, The angle between the formation and the well bore, degrees.
β, Apparent formation dip in the direction of the well bore, degrees.
Well drifts updip
θ = 90°-drift angle+β

Fig. 6.

subsea depths are shown on the electric log. The only other information needed for a solution is the structural difference betwen points A and B at the horizon being isopached. As shown in Fig. 4 this is interpreted to be (2,540 ft. − 2,394 ft.) or 146 ft. From Equation 1:

$$\text{Correction factor} = \frac{(2{,}771 - 2{,}394) - 146}{(3{,}586 - 3{,}100)} = 0.475 \qquad (1)$$

If the net sand count between points A and B on the electric log is 245 ft., the corrected vertical sand thickness is 245 (0.475) or 108 ft.

Solution by the Trigonometric Method

This method requires the knowledge of an average well-bore drift angle for the interval to be isopached, and the apparent formation dip in the direction of the well bore. Equations 4 and 8 can then be used for the solution. For the case where the well-bore drift angle varies, an average value can often be estimated from the directional survey. In extremely long sand sections such as the one used in this example, it is better to use a weighted average value where accuracy is desired. There are several ways of finding an average drift angle for a long interval, but the authors' choice is a method using the distance between each set of survey points to weight the average angle. The end result is a weighted angle that is obtained in the manner shown in Table 1 which is self-explanatory.

The apparent formation dip is obtained from Fig. 4, using the structure contours at the top of the interval being isophached.

$$\arctan \beta = \frac{\text{Structure change from M to N}}{\text{Horizontal distance from M to N}}$$

$$\arctan \beta = 150/390 = 0.384$$

$$\beta = 21.0°$$

Since the well is drifting downdip, Equation 4 is used for finding the angle between the formation and the well bore.

$$\theta = 90° - \text{well bore drift angle} - \beta$$

$$\theta = 90° - 41.5° - 21.0° = 27.5°$$

Then Equation 8 can be used to calculate the correction factor

TABLE 1—Method of Determining the Average Well Bore Drift Angle

(1) Survey Station No.	(2) Measured well depth	(3) Well bore drift angle	(4) Distance between stations	(5) Av. angle between stations	(6) (4×5)
1	3105	43.75			
			50	43.50	2175
2	3155	43.25			
			100	42.75	4275
3	3255	42.25			
			100	41.63	4163
4	3355	41.00			
			80	40.58	3246
5	3435	40.15			
			95	40.58	3855
6	3530	41.00			
			90	40.50	3645
7	3620	40.00			
			Σ515		Σ21,359

$$\text{Av. weighted angle} = \frac{\Sigma(6)}{\Sigma(4)} = \frac{21{,}359}{515} = 41.5°$$

$$\text{Correction factor} = \sin \Theta / \cos \beta$$
$$= \sin 27.5° / \cos. 21.0° \quad (8)$$
$$\text{Correction factor} = 0.4618/0.9336 = 0.494$$

The corrected, vertical sand thickness is 245 (0.494) = 121 ft. This value is considered more accurate than the figure obtained with the ratio method, because of the varying drift angle as explained above.

Solution by Trignometric Method Using Nomographs

Three nomographs have been prepared for the quick, easy solution of β, Θ, and the correction factor. These are shown in Figs. 5, 6, and 7.

Given data:

From the structure contour map, Fig. 4:

Structure change from M to N = 150 ft.

Horizontal distance from M to N = 390 ft.

Well-bore drift angle, Table 1 = 41.5°.

Nomographic solution:

In Fig. 5 a straight line between the structural change of 150 ft. and the corresponding horizontal distance of 390 ft. intersects the β scale at 21.0°.

Because the well drifts downdip, the left side of Fig. 6 is used to obtain Θ. An angle of 27.5° is obtained by entering 41.5° for the well-bore drift angle, and 21.0° for β.

A correction factor of 0.494 is then found from Fig. 7 by entering 27.5° for Θ and 21.0° for β.

Acknowledgment

The authors express appreciation to the management of the Oil Development Division of Union Pacific Railroad for permission to publish this paper.

How Shell will clean up its waste water

A BIOLOGICAL FILTER will be added to the effluent control system of Shell Oil Co.'s Houston refinery. The filter will use a system comparable to the self-cleansing action of a natural stream of water, Shell says.

The filter's purpose is to improve significantly the refinery's waste water. It will be the first refinery installation in the Houston Ship Channel area to use nature's "wonder bugs" in this manner, Shell claims. Completion is scheduled for fall 1961.

The biological method has purified domestic sewage for many years, but has been used only in recent years for treating refinery and industrial wastes. Shell says its project represents over 2 years of experimental design work.

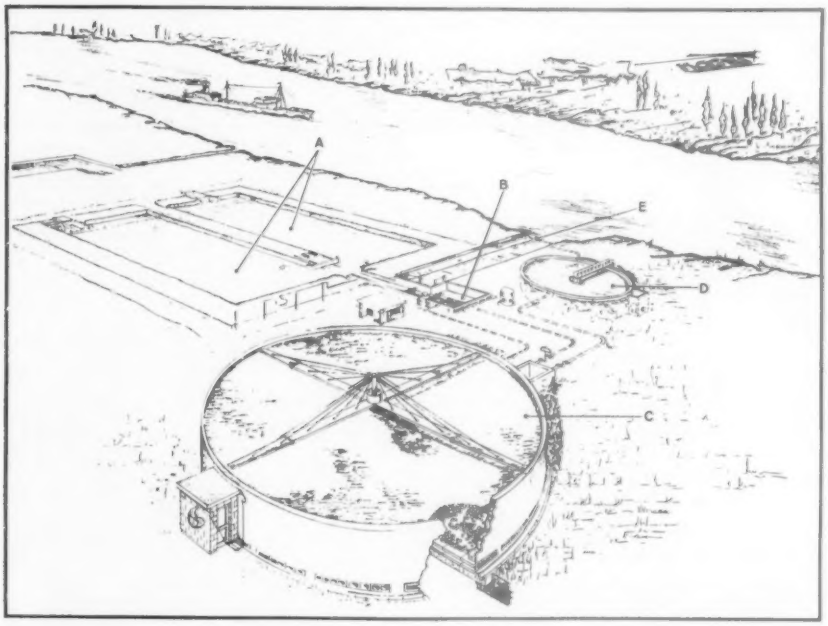
Effluent control system. The new facilities will be located near the Houston Ship Channel, except for the acidity-alkalinity control station which will be near the distilling and treating separator units.

Effluent water will enter two existing settling ponds and will pass then into a large gathering basin. Lift pumps at the gathering basin will discharge the water through a rotary distributor mounted above the biological filter.

Crushed trap rock, carefully graded for size, will fill the open top tank, of 23,000-sq.-ft. area. The four rotating arms of the distributor will give a uniform water flow down through the rock fill.

Filtered water from the filter will enter an adjoining clarifier where any remaining objectionable solids will be removed and empty clear water only into the ship channel.

Purification occurs as the water trickles through the rock fill. The surface of the rocks will be covered with a variety of living organisms and cellular matter such as bacteria, protozoa, and algae. These feed on the objectionable materials present in the waste water.



HOW SHELL'S biological-filter facilities will appear when completed. The major elements include: (A) two existing settling ponds which will be the wastewater collecting point; (B) location of the water-gathering basin and lift pumps to move water to the biological filter; (C) biological filter with a four-arm rotating distributor and filled with graded trap rock; (D) clarifier to remove any objectionable solids that still remain, and (E) clear-water outfall into the ship channel.

W. L. NELSON, Technical Editor and Petroleum Consultant

COSTimating

Itemized Cost Indexes

THE COST INDEXES may be used to convert prices at any date to prices at other dates by ratios of the cost indexes of the same date. Itemized indexes are published each quarter (first weekly issues of January, April, July, and October). In addition, the Nelson Construction and Operating Cost Indexes are published in the first issue each month of The Oil and Gas Journal.

	1950	1954	1957	1958	1959	Aug. 1960	References*	Index for earlier years (The Oil and Gas Journal) in Costimating and Questions on Technology issues
Operating costs (based on 1956 as 100.0):								
Power, electrical, industrial	97.3	¶98.5	¶101.6	¶102.8	103.2	105.0	Code 541-03	
Fuel, refinery	70.3	86.5	¶112.0	¶102.1	103.5	114.0		No. 4, Mar. 17, 1958
Gulf cargoes	78.0	85.9	123.8	102.9	93.5	107.5		No. 4, Mar. 17, 1958
N. Y. barges	76.9	82.6	112.3	93.0	85.9	94.9		No. 4, Mar. 17, 1958
S. Pedro bunkers	65.9	84.3	129.2	114.6	99.5	99.5		No. 4, Mar. 17, 1958
Oklahoma	77.7	62.0	105.3	66.3	78.8	88.7		No. 4, Mar. 17, 1958
Natural gas at wellhead	60.2	¶93.5	¶110.1	¶118.3	130.3	146.6	Code 531-01	
Industrial chemicals	83.3	96.9	101.9	101.8	102.1	102.7	Code 61	No. 58—Oct. 12, 1959
Phosphoric acid	86.7	96.6	100.9	103.4	103.4	103.4	Code 611-07	No. 58—Oct. 12, 1959
Sulfuric acid	80.8	100.0	100.0	100.0	100.0	100.0	Code 611-09	No. 58—Oct. 12, 1959
Ammonia	104.8	103.0	98.3	103.8	105.1	106.5	Code 611-13	No. 58—Oct. 12, 1959
Lime	64.6	92.0	106.4	104.4	106.1	109.2	Code 611-29	No. 58—Oct. 12, 1959
Sodium carbonate	75.5	92.9	104.3	104.3	104.3	104.3	Code 611-65	No. 58—Oct. 12, 1959
Sodium hydroxide	76.3	90.9	103.6	112.6	115.7	115.7	Code 611-69	No. 58—Oct. 12, 1959
Sodium phosphate	87.5	95.5	101.1	104.6	104.6	104.6	Code 611-71	No. 58—Oct. 12, 1959
Furfural	79.0	100.0	100.0	100.0	100.0	100.0	Code 612-63	No. 58—Oct. 12, 1959
MEK, drums	80.0	94.5	105.2	106.9	103.3	103.3	Ch. & E. News	No. 58—Oct. 12, 1959
Phenol	81.3	90.4	103.2	102.7	96.8	95.2	Code 612-83	No. 58—Oct. 12, 1959
TEL	94.1	102.8	101.5	99.9	100.7	100.7	Supplier	No. 58—Oct. 12, 1959
Operating labor (wages)	72.0	88.7	103.9	105.4	111.5	113.4	Employ. & Earn.	No. 55—Nov. 3, 1949
Productivity	85.5	97.1	98.0	100.3	109.0	115.2	Employ. & Earn.	Sept. 24, 1956§
Construction wages (1946 = 100):								
Skilled construction	140.0	174.6	196.3	205.1	214.6	225.7	Eng. News Record	No. 55—Nov. 3, 1949
Common labor	148.1	192.1	221.0	235.7	248.6	264.7	Eng. News Record	No. 55—Nov. 3, 1949
Refinery construction	144.0	183.3	208.6	220.4	231.6	244.8		No. 61—Dec. 15, 1949
Equipment or Materials (1946 = 100):								
Arc-welding machinery		158.4	186.6	193.2	192.1	202.0	Code ‡1176	May 2, 1955§
Boilers, tanks and sheet metal	†136.0	147.3	176.3	175.1	177.2	181.0	Code 1072	April 21, 1952§
Building materials (nonmetallic)	127.0	143.6	159.9	161.7	163.5	163.8	Code ‡13	No. 22—Mar. 17, 1949
Brick—building	132.5	144.7	161.3	162.4	166.4	169.6	Code 1341	No. 20, Mar. 3, 1949
Brick—fireclay	153.4	193.1	232.7	238.7	244.4	244.4	Code 1342	May 30, 1955§
Castings (foundry products)	152.9	181.1	220.5	227.2	231.6	234.0	Code 1015	No. 46—Sept. 1, 1949
Clay products (structural, etc.)	134.6	159.1	184.0	187.0	191.4	193.6	Code 134	No. 20—Mar. 3, 1949
Concrete—ingredients	125.3	142.1	159.7	163.2	164.7	166.9	Code 132	No. 22—Mar. 17, 1949
Concrete products	124.4	138.5	149.0	151.0	152.9	154.6	Code 133	
Electrical machinery	134.9	159.9	¶188.6	192.7	195.8	194.0	Code ‡117	May 2, 1955§
Motors and generators	135.0	157.7	181.2	186.4	186.4	180.7	Code ‡1173	No. 31—May 19, 1949
Switch gear		171.2	¶212.0	218.8	223.5	219.7	Code ‡1175	May 2, 1955§
Transformers	131.6	161.9	188.0	187.3	188.6	179.4	Code ‡1174	No. 31—May 19, 1949
Engines (composite)	126.0	150.5	173.9	178.3	178.5	179.2	Code ‡1154	No. 36—June 23, 1949
Exchangers	140.0	¶171.7	203.6	181.2	179.3	196.0	Manufacturer	No. 2—Oct. 28, 1948
Copper base		¶190.7	191.4	168.8	169.6	186.5	Manufacturer	
Steel		¶156.8	213.2	190.0	186.4	203.2	Manufacturer	
Fans and blowers	162.9	192.6	236.1	241.7	244.4	246.8	Code 1174	Feb. 17, 1949§
Hand tools	143.2	173.8	214.3	224.7	230.4	235.2	Code 1042	June 27, 1955§
Instruments (composite)	127.8	154.6	187.4	194.9	201.0	204.3	Manufacturer	No. 34—June 9, 1949
Flowmeter (mechanical)	114.0	161.6	203.3	209.9	219.1	227.0	Manufacturer	No. 34—June 9, 1949
Flowmeter (air control)	138.5	179.6	208.2	216.3	223.5	231.3	Manufacturer	No. 34—June 9, 1949
Flowmeter (remote)	135.5	146.5	171.2	176.4	178.1	180.3	Manufacturer	No. 34—June 9, 1949
Potentiometer, 6-point	134.0	167.2	230.9	240.4	258.9	241.0	Manufacturer	No. 34—June 9, 1949
Potentiometer, air control	134.1	150.5	204.6	212.6	231.6	247.8	Manufacturer	No. 34—June 9, 1949
Pressure controller recorder	135.6	166.3	189.3	200.0	200.0	207.1	Manufacturer	No. 34—June 9, 1949
Pressure gage	101.2	108.6	119.2	119.2	119.2	119.2	Manufacturer	No. 34—June 9, 1949
Thermometer (recording)	124.0	152.8	171.8	179.7	179.7	186.0	Manufacturer	No. 34—June 9, 1949
Control valve	133.3	162.0	187.8	199.3	199.3	199.3	Manufacturer	No. 34—June 9, 1949
Lumber (composite)	193.0	197.8	201.8	198.9	214.1	201.0	Code 81	No. 7—Dec. 2, 1948
Southern pine	176.9	181.2	187.6	184.7	190.9	186.3	Code 812	No. 7—Dec. 2, 1948
Other soft woods	230.2	252.7	257.6	251.2	266.8	245.2	Code 813	No. 7—Dec. 2, 1948
Machinery:								
General purposes	136.7	159.9	196.5	199.6	206.0	207.5	Code 114	Feb. 17, 1949§
Construction	140.1	165.9	199.4	209.6	217.0	222.8	Code 112	
Oil field	†135.8	†161.9	193.2	192.5	192.6	192.8	Code 1151	Oct. 10, 1955§
Paints—prepared	140.0	159.0	178.1	180.9	179.9	181.0	Code 621	May 16, 1955§
Pipe:								
Sewer	120.7	140.1	168.0	170.1	176.2	178.2	Code 1345	No. 22—Mar. 17, 1949
Black iron	160.0	195.0	256.1	264.8	263.8	258.4	Code 1014-56	No. 19—Oct. 15, 1956
Six-inch line	†159.0	200.5	268.3	276.9	275.9	246.3	Code 1014-58	
Pumps, air compressors, etc.	138.2	166.5	206.7	214.7	226.5	228.8	Code ‡1141	No. 29—May 5, 1949
Steel (iron and steel)	152.9	179.6	224.5	228.2	232.4	229.5	Code 101	No. 61—Dec. 15, 1949
Steel—finished steel	153.7	187.1	232.5	240.6	244.7	243.9	Code 1014	July 25, 1955§
Plate		187.0	241.8	252.7	257.4	257.4	Code 1014-26	Mar. 4, 1957§
Structural shapes	162.7	193.4	252.2	262.8	268.5	268.5	Code ‡1014-31	No. 18—Feb. 17, 1949
Seamless tubes, 2-2¼ in.	149.5	199.4	265.4	277.5	285.1	281.5	Code 1014-61	Sept. 5, 1955§
Valves and fittings	†135.8	197.1	243.4	242.7	257.6	251.2	Code ‡1149 (10 items)	No. 46—Sept. 1, 1949
Nelson Refinery Construction (1946)	146.2	179.8	205.9	213.9	222.1	230.0		No. 36—Aug. 5, 1957
Nelson Refinery Operation (1956)	72.4	88.7	¶106.7	¶105.8	106.8	108.8		No. 2—Mar. 3, 1958
Nelson Refinery Process Operation (1956)	75.1	88.4	¶107.7	105.8	106.0	107.4		No. 2—Mar. 3, 1958

*Code refers to the revised index code number of the Bureau of Labor Statistics, U. S. Department of Labor, "Wholesale Prices."
†Estimated base value for 1946.
‡Not exactly the same items as those published before July 7, 1952.
§Questions on Technology, The Oil and Gas Journal. ¶Revised.

1960 saw some real advances in pipe laying

BY PAUL REED
Pipeline Editor

LITTLE PIPE GANG ahead of main pipe gang increases footage of small-diameter pipe.

EFFORTS TO GET more daily footage from pipeline spreads have been pushed in two directions during the past year. Two different techniques are progressing, each with possibilities of increasing spread output by about 30% under favorable conditions: (1) For small-diameter pipe, a two-pipe-gang method has been demonstrating its value; (2) for large-diameter pipe, double jointing has been increasing steadily with promise of greater use in 1961.

These are the most impressive measures from the standpoint of cost reduction to be observed in pipeline construction during the past year. After discussing them briefly, this article will deal with some details of other practices observed on a trip to several pipeline spreads mostly in Iowa and Illinois toward the end of the 1960 construction season.

The two-pipe-gang method showed what it could do when a Williams Brothers spread welded 32,000 ft. of 6-in. in a 10-hour day. A record was probably set. This spread was one of the contractor's three spreads using the two-pipe-gang method in laying pipe for the Mid-America Pipe Line Co. project completed late in the year from New Mexico to Minneapolis and Milwaukee. A fourth spread on the project used only one pipe gang since it operated in less favorable territory.

The three spreads using the two-pipe-gang method averaged 20,000 ft. per working day.

Two-Pipe-Gang Method

The two-pipe-gang method functions by having a small pipe gang—sometimes called a half pipe gang—ahead of the main pipe gang. A typical small pipe gang on this project was seen near Spencer, Iowa, laying 6-in. It had one stringer bead and one hot-pass welder. This small gang was working on a section more than a mile ahead of the main pipe gang. All operations for running the stringer bead were completed in 2 to 2½ minutes. Operation of the small gang was expected to contribute a third of the footage of the spread.

The main pipe gang had two stringer-bead, and three hot-pass welders. There were eight firing-line welders. Stringer-bead operations were completed in 1 minute.

By using two external line up clamps in each gang, the stringer bead welders were not delayed by lineup operations.

The small pipe gang worked on mile-long sections and leapfrogged ahead around the next section to the section beyond.

Only a few changes had to be made in the spread to facilitate the fast pace. Two more welders and their helpers were added to the firing line and one or two more units were put in the cleanup gang. An additional stringing truck was also needed. Ordinarily it was not necessary to add a ditcher.

Ditching, bending, and coating were accelerated by the pressure of the fast pace so that they kept up with or ahead of the pipe gangs.

The small pipe gang numbered 14 men and the main pipe gang had 28 to 30.

The two-pipe-gang method has been used off and on by Williams Brothers for several years. It has proved to be successful for laying small-diameter pipe on long jobs in fairly open level or gently rolling country. Plenty of room with few obstructions is desirable.

Some organization changes have been made since 1959 when the two-pipe-gang method was used by the contractor in laying pipe for the Kaneb project. Stringer-bead welders in the small pipe gang were reduced from two to one; and two welders were added to the firing line.

In 1958, Williams Brothers had two-pipe gangs working part of the time for laying 36-in. for a project in Kansas and Nebraska. But experience indicated that the two-pipe-gang method is only suitable for small-diameter pipe. Coating operations cannot travel as fast on large pipe as on small pipe. This is an impediment to the fast progress that should be gained by the method.

Double Jointing

For large-diameter pipe, a trend is gaining momentum this year for longer joints—either 60 ft. from the mill or 80 ft. from portable double-jointing plants. Advantages of the double joints were extensively tested

STREAMLINED PIPE GANG of same contractor (Williams Brothers) who uses double joints on big inch where conditions are favorable.

early in the year when they were laid in mountain country during winter weather on the Transwestern project. The current status of double jointing will be discussed in a separate article.

Near Sullivan, Ill., the highly developed automatic submerged-arc double-jointing plant of Stanley-Bledsoe Corp. was visited. This was of the same type as the one the firm developed for operation at the Republic Steel Corp. mill at Gadsden, Ala. At the time it was visited production had been delayed by increased welding required for an unusually large number of pup joints which had been delivered from the mill furnishing the pipe. In preparing for the faster progress expected from the 80-ft. joints, a third ditcher had been added to keep ahead of the pipe gang.

Spreads visited on trips in the latter part of the year include the following:

Williams Brothers, laying 6-in. near Spencer, Iowa, on the Mid-America Pipe Line Co. 2,200-mile system.

River Construction Corp., laying 36-in. near Red Oak, Iowa; and Pentizien, Inc., two 30-in. Missouri River crossings at Plattsmouth, Neb., both for parts of Natural Gas Pipeline Co. of America's 327-mile looping program.

Stanley-Bledsoe Corp., 30-in. near Sullivan, Ill., for a section of Peoples Gulf Coast Natural Gas Pipeline Co.

R. H. Fulton & Co., Leon, Iowa, 24-in.; Majestic Contractors, Inc., 30-in., Sandwich, Ill.; and Bechtel Corp. 24-in., Michigan City, Ind., for the 534-mile looping program of Michigan Wisconsin Pipe Line Co., supervised by Ford, Bacon & Davis, Inc.

Williams Brothers, 47-mile 24-in. near Broken Arrow, Okla., for Transok Pipe Line Co.

Daily Footage

Average daily footage per calendar day was reported for 24 and 30-in. pipe as approximately 6,500 ft. On certain days under favorable conditions daily footage went up to 8,000 and 10,000 ft. In laying 36-in. pipe in a section across choppy country in Iowa average footage was 5,700 ft. per calendar day—a rate of progress consistent with that of 2 years ago when the same size pipe was laid over similar terrain in the same general area.

Certain trends in equipment and details of construction attracted attention.

Air clamps. What the air clamps are doing to speed up the pace of pipe laying is shown in time records of pipe gang operations. Line-up now takes only 20 to 30 seconds. Only a few hammer blows are needed for jarring the clamp mechanism into place. Formerly lineup with mechanical clamps frequently took a minute or more with much hammering to pound out the high-lows in the pipe.

At the 24, 30, and 36-in. gangs, it was observed that total time for lineup and running the stringer bead was mostly 1 to 1½ minutes—seldom as much as 2 minutes or more.

Clamp time. Length of time specified for having the clamp in the pipe, during stringer bead welding, varies from company to company. Ford, Bacon & Davis, Inc., supervising engineers for constructing the Michigan Wisconsin loops, specified that the clamp should remain in the lineup position during 85% of the time that the stringer bead is run. Natural Gas Pipeline of America and Peoples Gulf Coast Natural Gas Pipeline Co. specified 95%. New York State Natural Gas Co. and Pacific Gas & Electric Co. have specified 100%.

Improvements being made in the new clamps, especially those with self-propelling features, are speeding up clamp operations further.

Disk grinders. Grinding the stringer bead with a power-driven disk grinder before running the hot pass was being done at the River

WATCHING for indications of a "wave" in bending 36-in. pipe. Bending of larger diameters requires close attention.

THREE STRINGER BEAD WELDERS running stringer bead on Michigan Wisconsin Pipe Line Co. project.

Construction spread laying 36-in. pipe for Natural Gas Pipeline Co. of America. This practice is recommended but not specified by the pipeline company.

Quality of the finished weld is improved according to tests conducted by A. G. Barkow, superintendent of the pipeline company's inspection department.

Even though the cost of the grinding disks is high enough to discourage some contractors, River has found disk grinding of stringer beads to be advantageous.

On this job the practice was considered of much importance for improving welding quality and thereby reducing the number of rejected welds.

Disk grinding levels the stringer bead and removes slag lines and "wagon tracks." The second bead is applied with better penetration. Completed welds are more uniform and look good in X-ray inspection.

Grinding time was about 25 seconds. Grinding disks at the River spread were 7-in. in diameter and 3/16-in. wide. Grinders were of the familiar type used by pipeline utility welders. At some of the other spreads 9-in.-diameter disks were reported as being used.

POWER DISKS grinding stringer bead for improved welding quality on 36-in. pipe on Natural Gas Pipeline Co. of America line at Red Oak, Iowa.

A third of the welds on cross-country pipe and 100% of the crossing welds are X-rayed according to usual current practice.

Preheating equipment was on hand at some of the spreads in anticipitation of cold-morning requirements later in the season.

To safeguard welders from the dangers of caving ditch, River Construction had a "bell-hole cage" on the job ready to be used where needed.

Tractor - mounted twin arc-welding machines driven by the tractor engine were in the majority in the pipe gangs visited, in accordince with recent trends.

The spreads were quite evenly divided in the use of rig welders and single hand welders in the firing line.

Pipe gangs in 36-in., 30-in., and 24-in. jobs had three stringer bead welders with the exception of the one on the Stanley-Bledsoe spread which had four stringer-bead welders on 30-in. pipe. There were four to six hot-pass welders on the various spreads. The River Construction spread laying 36-in. had 6 hot-pass and 18 firing-line welders.

Acknowledgment

Assistance in the preparation of this article was given by Kieth Bentz, vice president of operations, and D. C. Palm, general superintendent of pipeline division, Natural Gas Pipeline Co. of America; M. S. Trimble, project manager, Ford, Bacon & Davis, Inc.; E. M. Hubach, general superintendent Williams Brothers; and Clark C. Bledsoe, president, Stanley-Bledsoe Corp.

Here are the

Three T's of good combustion

IN THE REFINERY, we are not concerned with perfect combustion. This is only possible in the laboratory.

We are interested, however, in the most efficient burning of fuel. The most efficient combustion is complete with about 15 to 20% excess air. This is sufficient air to assure that all of the carbon will be burned to carbon dioxide without wasting fuel in heating up a large amount of excess air.

The job of burning fuels in refinery furnaces is, of course, more complex than just writing a set of equations. Three things are required of any refinery furnace system.

(1) Fuel must be prepared for combustion; if it is a liquid, it must be converted to a vapor.

(2) Fuel and air must be brought together in the right proportion, and at the proper time and temperature for ignition and combustion.

(3) Heat from the products of combustion must be transferred to the furnace tubes. At the same time, sufficient heat must be retained in the combustion zone.

Gas burners need only to proportion the volume of air and gas and insure thorough mixing. Oil burners, however, must prepare the fuel by breaking it up into small particles. This exposes the maximum possible surface to allow rapid conversion to a vapor by furnace heat.

The steps of mixing, igniting, and burning occur in the small time interval while fuel and air are traveling from the burner to the stack inlet. This time interval depends upon the distance traveled, and the speed, and the degree of turbulence.

Turbulence describes the condition in which fuel and air whirl in irregular paths from burner to inlet of the stack. Turbulent flow is desirable, since the total distance the vapor travels is increased by following an irregular course. Thus the time available for combustion is increased.

The burner and furnace have separate functions in the over-all job of combustion. The furnace can do little to correct the shortcomings of the burner and vice versa.

Good combustion has been aptly summarized as depending upon the three "T's"—Time, Temperature, and Turbulence.

This material taken from process-training-program manual, Bayway, N. J., refinery of Esso Standard Division, Humble Oil & Refining Co.

Combustion Equipment

Furnaces are simply heat-exchange equipment. Fuel burning in the furnace exchanges heat with the process fluid flowing inside the tubes.

Furnace tubes that are directly above, beside, or beneath the flame are in the radiant section. These tubes normally "see" the flame and are heated by radiation from the flame and hot brickwork.

Tubes in the zone through which the hot flue gases pass on their way to the stack are in the convection section. As the name implies, heat transfer here is primarily by convection. Hot flue gases flowing past the tubes exchange heat with the material flowing inside the tubes.

Fig. 1 shows a composite of the types of furnaces used in a refinery.

About 50% of the heat released in a furnace is transferred to the oil in the radiant section, 25% in the convection section, and 25% is lost out the stack with the exit gases.

Exit gases are made up mostly of nitrogen from the air and the products of combustion. They are costly to first heat and then lose to the atmosphere. Strict control of air flow through the furnace is vital to economical operation.

Burners are the means of mixing and converting oil, gas, steam, and air to fired heat. In general, all burners used in refinery furnaces are of the combination gas-oil type. To understand the operation of the burner, let us first look at the gas and oil parts of this burner separately.

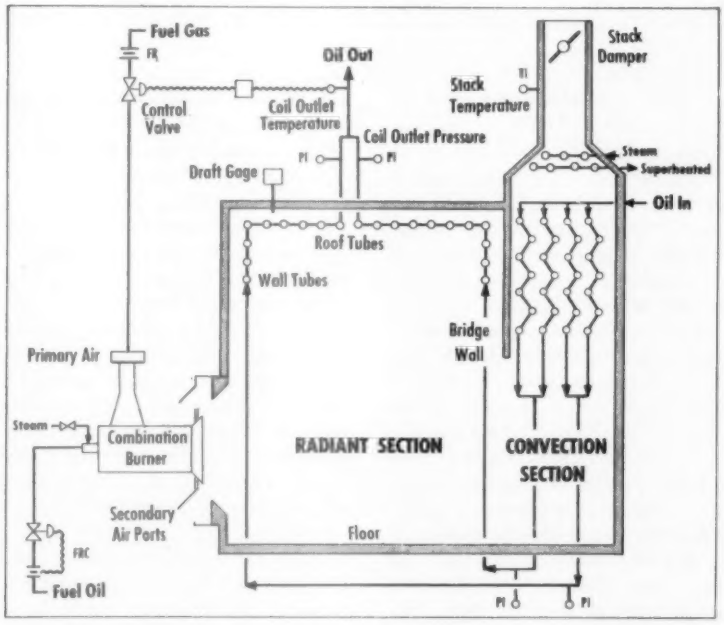
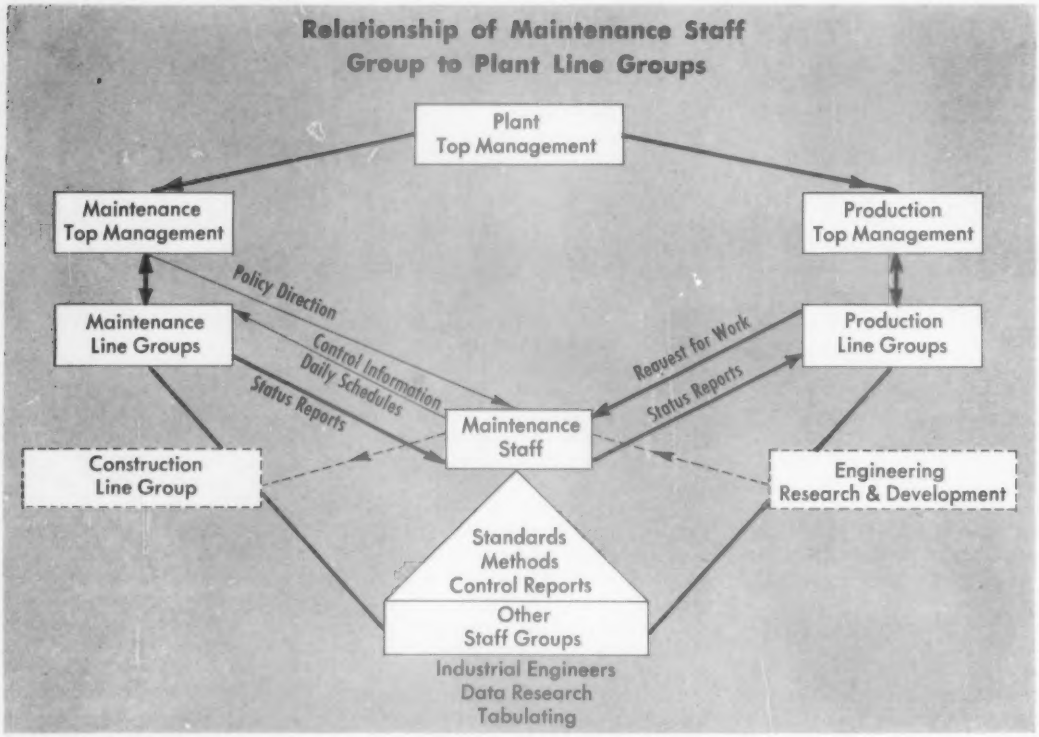


DIAGRAM of a typical refinery furnace. Although they may differ from the arrangement shown here, most modern stills have both a radiant and convection section. Fig. 1.



MAINTENANCE-WORK instructions move from the operating group through planning directly to the maintenance foreman. **Fig. 1.**

Maintenance planning saves for Ethyl

Baton Rouge plant cuts costs 20 per cent in first 2½ years

MAINTENANCE PLANNING and scheduling at Ethyl's Baton Rouge plant resulted in savings of almost 20% of total maintenance costs during the first 2½ years' operation of the program.

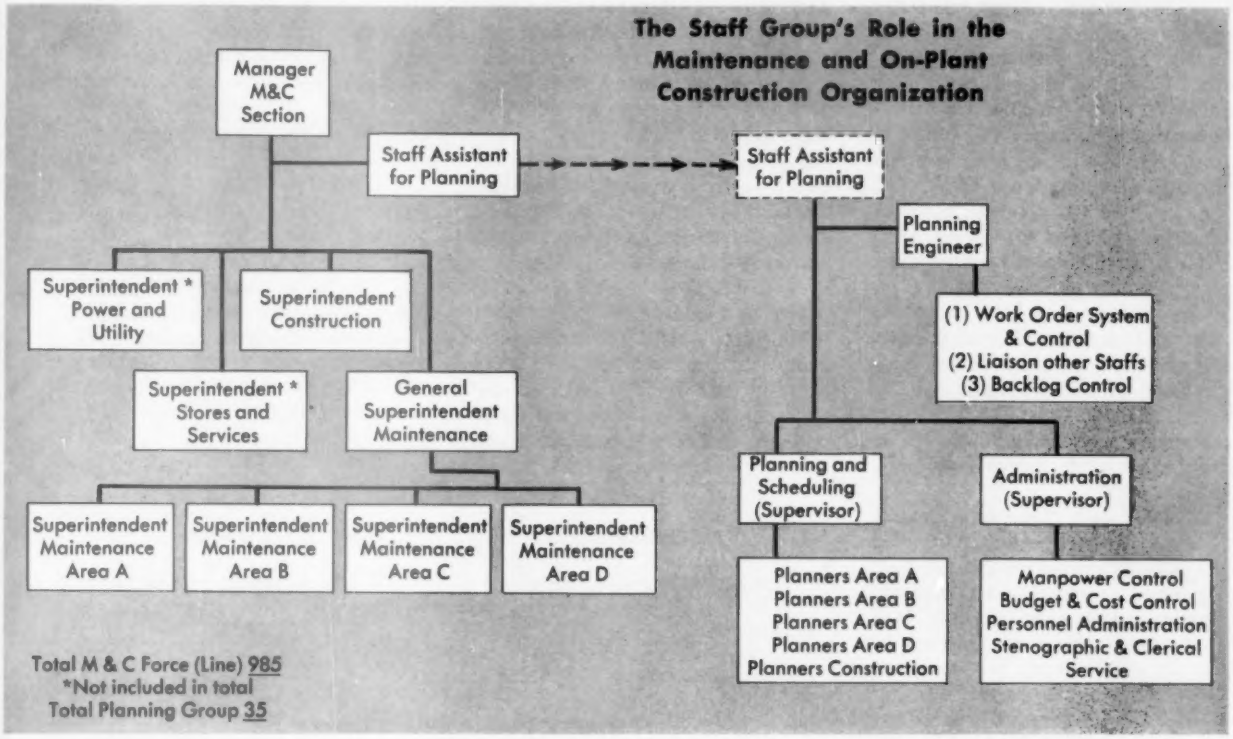
Generally speaking, Ethyl's program consists of a staff planning group that works out the complex assignment of men and materials, process-equipment availability, etc., for the field foreman, and acts in a liaison capacity between the operating and maintenance departments. Key to the successful program was choosing planners who could not only translate maintenance problems into accurate estimates of hours of work, methods, crafts, equipment, materials, etc.; but, also could use diplomacy, sound judgment, and patience in dealing with other supervisors of equal, or higher, rank in the organization.

BY I. R. SCHNEIDER
Ethyl Corp.

Work studies. For years, we at Ethyl watched our maintenance budget grow to one of the largest cost items of manufacture. Classical manpower-control methods had not been able to keep this cost in check. So, work-sampling studies were planned and executed for a test area of the plant by the industrial engineering group. These studies produced the kind of data needed to give top management the facts about our existing maintenance program. Without going into job detail, the study showed that a mechanic was working effectively only 29 minutes out of each hour. Also, it showed that 15 minutes were lost due to unavoidable conditions such as smoke breaks, personal time, emergency work, etc., and 16 minutes due to avoidable delays such as no-materials-delivered, critical craft not available, equipment not ready for maintenance, etc.

Recovery of any part of the 16-minute avoidable delay for some 500 mechanics across the plant could result in large annual savings For example, a 5-minute per hour recovery would save $425,000 per year, either by getting that much more maintenance work done or by making maintenance labor available for new plants, processes, construction programs, or by force reductions. This obviously was the area where savings could be easily demonstrated.

The fundamental concept of a foreman and his crew performing a maintenance task was the basic solution of the problem. Why not clear the air for the foreman, eliminate the annoying problems that



STAFF PLANNING GROUP works out complex assignment of men and materials, process-equipment availability, and produces a daily schedule for each maintenance foreman. **Fig. 2.**

prevented him from getting the job done and looking after the welfare of his crew? Set up a staff organization to work out complex assignment of men and materials, process-equipment availability, and the like. Produce a daily schedule for each foreman which could be accomplished by his assigned crew.

Initial operation. With top management approval a pilot maintenance-planning group was established here at Baton Rouge. Its aim was to do the "leg work" for the field foremen and act in a liaison capacity between the operating and maintenance forces. It was an up-hill battle all the way. Everyone recognized the need of such help but selling it to the men in the field required tremendous fortitude and patience on both sides. New lines of communication had to be developed.

The key to this program was the planner. He had to understand every phase of plant operation and be able to translate the maintenance problem into accurate estimates of hours of work, methods, crafts, equipment, materials, etc. We chose the most experienced foremen we could, who were not only craftwise, but had other attributes as well. This new position called for diplomacy, sound judgment, and patience in dealing with other members of supervision of equal, or higher, rank in the organization. These planners no longer worked craftsmen and helpers; they were not involved in labor-relations problems; and for the first time in many years, they were moved from a field-type operation to desks, paper work, and a whole new set of relationships with wage-roll and supervisory people.

At first, the planning was approached on a craft basis with each planner responsible for a phase of a job involving his particular craft skills. Also no daily schedule was issued—rather, each field foreman was provided with a group of estimated work orders and the manpower to perform the work. From this beginning in 1956 has evolved the present approach to planning and scheduling work which even today continues to change as new problems are met and worked out.

The detailed planning and scheduling brought to light several other fundamental problems in the area of manpower cost control and supervisory responsibility. It also demonstrated the importance of a staff function in a maintenance organization.

Present duties. The staff idea began to grow and gradually other small services of a staff nature became the function of the planning group and finally, as ideas developed and evolved, most of the staff-type tasks of the maintenance and construction section were combined into one central core which today performs the following essential services:

1. Plans and schedules all maintenance and construction work.
2. Provides administrative and personnel services for the section.
3. Prepares budgets, analyzes costs, keeps records, and accumulates data.
4. Recommends programs of action to the line organization.
5. Develops control and reporting systems.
6. Serves as the control source for standards development.

The daily flow of maintenance-

work instructions moves from the operating group through planning directly to the maintenance foreman. Copies of all work schedules are available to maintenance supervisors and superintendents and they are responsible for all work requirements in their respective areas.

Once tasks are assigned, physical areas defined, and manpower allocated, each responsible superintendent (operating within the framework of general group policy) is on his own. Staff services of several kinds are available to him. He is kept appraised of his area work backlog by craft groups so that he can study requirements and make decisions as to the craft levels and over-all manpower needs.

A small staff group of engineers is available to handle particular technical problems in his area of responsibility. Weekly and monthly reports and a brief monthly cost review keep the superintendent appraised of his group performance.

Fig. 1 shows the interrelationship of the maintenance staff with the line groups in the organization. The primary function is that of planning and scheduling maintenance work requested by operating or production groups. The same service is rendered for on-plant construction work, and development and experimental work.

Engineering, research, and development groups provide the authority for work to be done and the construction forces perform the work. Other functions include working with staff groups such as data research and industrial engineering to improve cost reporting and control information and the development of standard data.

Fig. 2 shows how the staff organization fits into the over-all maintenance and construction organization. It supports the maintenance and construction organizations and provides little service to the power and stores groups.

Planning and scheduling provide the basic building blocks for a long-range maintenance standards program and preventive-maintenance programs. The daily schedules become the source material for raw standards; the equipment records are basic for preventive-maintenance programs. From time to time foremen are assigned temporarily to the staff group to develop preventive-maintenance schedules for their own areas and, thus, have the opportunity to bring their many years of experience into focus. In addition, these foremen become part of the standards program and when they return to their regular field assignments they are better equipped to direct the efforts of the craftsmen performing the task.

Size and cost. How large such a staff group should be depends on many things and will differ in every organization. Each planner in our planning and scheduling group supports 6 foremen in the field and approximately 60 craftsmen. This is an empirical figure based on the way we do our business, the detail we desire, and the controls we have established. It represents our requirements for a satisfactory level of maintenance.

The total staff group represents 3.6% of the total maintenance and on-plant construction force. The cost of such an organization is a real item in the overhead budget but has actually cost nothing over the long pull. During the period when the organization was developing, field jobs were filled from the ranks as foremen were selected for assignment in planning.

Nelson Refinery Cost Indexes

Published in the first issue each month in the Technology-Operations Section.

Compiled by W. L. Nelson, Technical Editor and petroleum refinery consultant, Tulsa.

Charts of the indexes are published each year in a late January or early February issue.

Indexes of selected individual items of equipment and materials are also published on the Costimating page in the first issues of the month of January, April, July, and October.

Refinery Construction Cost Index (1946 Basis)

Explained on page 101 of the issue of August 5, 1957.

	1950	1954	1957	1958	1959	Aug. 1960
Pumps, compressors, etc.	138.2	166.5	206.7	214.7	226.5	228.8
Electrical machinery	134.9	160.0	188.9	192.7	195.8	194.0
Internal-combustion engines	126.0	150.5	173.9	178.3	178.5	179.2
Instruments	127.8	154.6	187.4	194.9	201.0	204.3
Heat exchangers	140.0	171.7	203.6	181.2	178.9	196.0
Miscellaneous equipment average	*126.2	160.7	192.1	192.4	196.1	200.5
Materials component	149.5	174.6	201.9	204.2	207.8	207.7
Labor component	144.0	183.3	208.6	220.4	231.6	†244.8
Nelson construction index	146.2	179.8	205.9	213.9	222.1	230.0

*Used in computing the Nelson Index until April 1952.

†Converting Labor Component to 60% skilled labor rather than 50:50. Conversion will be complete by May 1961.

Refinery Operating Cost Indexes (1956 Basis)

Explained on page 171 of the issue of June 1, 1959.

	1946	1952	1954	1958	1959	July 1960
Fuel cost	49.6	81.0	86.5	102.1	103.5	111.4
Labor cost	73.1	88.7	90.9	105.0	102.3	98.6
Wages	52.4	81.5	88.7	105.4	111.5	114.9
Productivity	68.3	90.2	97.1	100.3	109.0	116.5
Investment, maintenance, etc.	51.2	83.6	92.0	109.5	113.7	117.5
Chemicals cost	37.0	72.1	85.7	104.4	107.8	113.3
Operating cost indexes:						
Refinery	58.5	80.5	88.7	105.8	106.8	108.4
Process units‡	62.9	82.2	88.4	105.8	106.0	106.8

‡Add separate index for chemicals, if any are used.

How to combat gas lock in pumping

BY JOSEPH ZABA

THE OLDEST and simplest device for bottom-hole separation of oil and gas is the gas anchor. Several types are in general use and one of these is shown schematically in Fig. 32. In the annulus between the mud anchor and the casing the velocity of flow of the well fluid increases with resulting turbulence. This results in partial separation of free gas and evolution of some of the solution gas. The gas escapes directly into the annulus.

The second point of turbulence is the point of change of direction of flow where oil enters the mud anchor-gas anchor annulus through the perforated nipple. During the downward flow of oil through this annulus the gas bubbles coalesce, rise through the fluid and escape through the upper part of the perforations into the casing-tubing annulus. A relatively gas-free oil enters the pump through the gas-anchor pipe.

To be efficient the gas anchor must meet certain conditions. To provide vent holes for escape of gas the combined area of holes in the perforated nipple should be at least four times the area of the standing valve. The annular area between the mud anchor and the gas anchor should be large enough to assure slow downward velocity of oil.

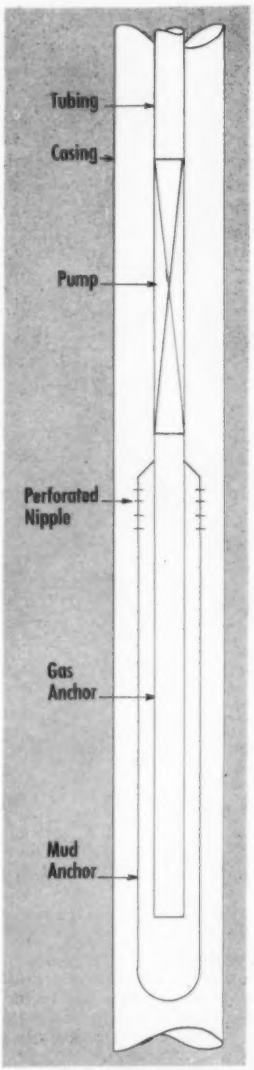
This velocity should be kept below the velocity of rise of gas bubbles through oil, which is a function of size of the gas bubbles and of oil viscosity. In water this velocity is around 6 in. per second for bubbles with diameter of 0.01 ft. and this figure has been sometimes used in gas-anchor calculations for oils with common viscosities.[1]

Diameter and length of the gas anchor are quite critical. Any gas evolved within the gas anchor as a result of pressure drop must be handled by the pump. In large-volume wells pressure drops may result in excessive evolution of gas. In low-fluid wells the excessive pressure drops may lead to conditions of starving the pump suction.

TABLE 10—PRESSURE DROPS IN GAS ANCHORS

Gas anchor		Pressure drop
Size (in.)	Length (ft.)	(psi.)
¾	10	21.2
¾	20	42.4
1¼	10	2.3
1¼	20	4.1

R. L. Chenault reported on experiments to determine the pressure losses in the gas anchor of an installation handling 100 cp. oil with 1¾-in. pump operating at twenty 54-in. s.p.m.[2] The results, Table 10, show that a short, large-diameter anchor is preferable. These results, however, should be considered in light of two qualifications. First, increasing the diameter of the gas anchor may reduce the annulus between gas anchor and mud anchor in a manner which would increase the velocity of the downward flow above the critical limit mentioned above. In such a case use of oversized mud anchor should be considered if this is feasible with the available casing size. Incidentally, this would decrease the casing mud-anchor annulus, with resulting increase in velocity of flow through this annulus, a preferred condition. Second, as far as the length of the anchor is concerned, the oil entrance of the gas anchor pipe should not be too close to the zone of turbulence created at the entrance of oil through the perforated nipple into the mud anchor, probably not closer than 5 ft.



ONE TYPE of gas anchor. Oil in the tubing-casing annulus spills through the perforations to the gas anchor where it can be picked up by the pump. Gas escapes through casing. Fig. 32.

A properly designed, shopmade gas anchor still remains a very satisfactory tool for reducing gas interference in many types of wells. A report has been recently presented on a group of wells in West Texas and New Mexico in case of which, after a systematic study of well conditions, certain steps were taken to minimize gas interference.[3] In the case of four wells the only step taken was installation of properly designed, shopmade gas anchors. This resulted in a 70% increase in production of these wells. In a group of 15 wells, by making certain operating changes and installing the shopmade gas anchors, production was increased by around 40%.

Bottom-Hole Separators

During the past several years a number of devices have been developed to improve the efficiency of bottom-hole separation over that of ordinary gas anchors. These devices are usually referred to as bottom-hole separators.

A number of variations of these devices are commercially available. A group of them employs a common basic principle with variations in details of design. The principle is as follows: The tubing is packed off in the casing. The well fluid is taken from tubing into a separate eductor through a crossover at the packer and is released into the casing-tubing annulus a certain distance above the

packer. Increased velocity and turbulence in the eductor and the relatively large area of the annulus are conducive to quite efficient separation. The fluid reenters the tubing from the bottom of the annulus accumulation chamber through tubing perforations immediately above the packer and is picked up by the pump.

Fig. 33 shows, schematically, one of these separators. Fluid crosses over at the packer into 20 or more feet of ¾ or 1-in. pipe attached to the outside of the tubing and overflows at the top of the pipe into the annulus, where the separation takes place. The relatively gas-free fluid is taken into the tubing and the pump, through the tubing entry ports above the packer. In another design of this type the eductor is a small pipe inside of tubing and the fluid overflows into the annulus through a special perforated collar. In still a third type the fluid enters the annular space formed above the packer by certain length of line pipe which forms a skirt around the tubing. From this space the fluid overflows into the casing annulus a certain distance above the packer. Again, the fluid is taken into the tubing and the pump through ports in the tubing above the packer.

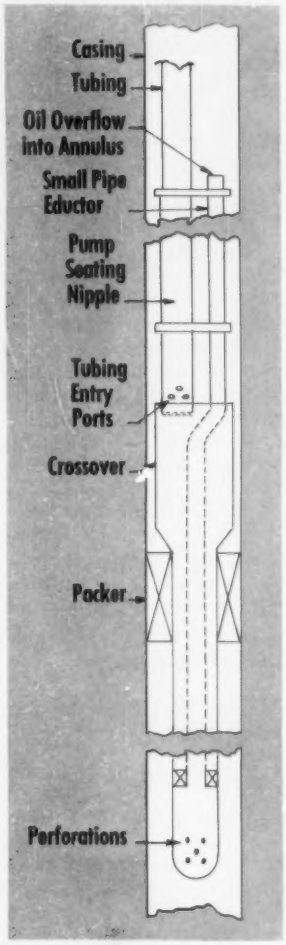
Criteria used in selection of wells for installation of bottom-hole separators are similar to those used in selection of wells for installation of gas anchors because of indicated gas-interference conditions. These indications are (1) high working fluid level with small production although the subsurface equipment is in good state of repair, (2) high gas ratios, and (3) heading type of production. Data secured from dynamometer cards are of particular value in such considerations. Most likely candidates for use of separators are wells in which installation of gas anchors did not furnish the expected results.

Use of botttom-hole separators presents certain disadvantages. There is always the possibility of stopping up the small entry and exit ports. In the case of separators using packer there is always a risk of sticking the packer or, if the packer is pulled up, buckling the tubing in compression, with the resulting rod-on-tubing wear.

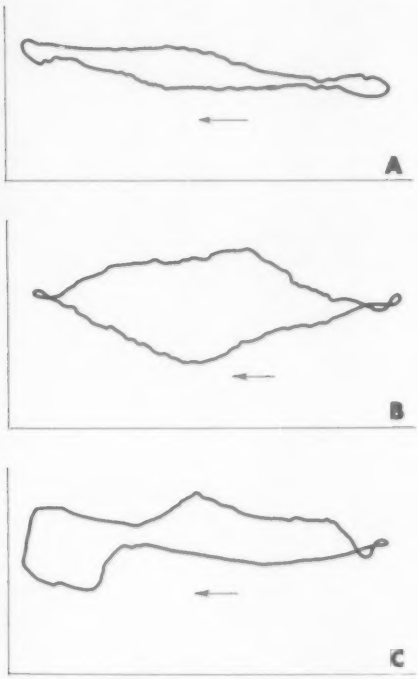
Also, the bottom-hole separator is not a universal solution of gas interference problem. In general, however, the separators were quite successful in a number of installations in properly selected wells.

Fig. 34 shows dynamometer cards taken on a well before and after installation of a bottom-hole separator. Card A, taken before installation, shows because of its small area, that the pump is performing very little work. Under conditions of this well this was an indication of gas interference. Card B taken after installation of the separator, and after the well was shut down for a short time, indicates good pumping action. Card C, taken a short time after Card B, shows a definite fluid pound, with well pumping off. The well could not be pumped down prior to the installation of the separator which in this case resulted in increase of well's production by slightly over 100% without change in subsurface equipment, in length of stroke or in speed of pumping.

Bottom-hole separators have been used quite extensively in certain fields in the Rocky Mountain area. It has been reported that in one of these fields installation of bottom-hole separators in a number of problem wells resulted in an increase of 22,000 bbl. per month with an average 12-day payout of the installation cost[4]. In other cases the over-all results were not as clear cut because installation of separators was accompanied by other steps which were taken to increase production. Nevertheless, the results on some of the individual wells were quite satisfactory. One of the advantages cited in the report is the fact that some of the wells which were heading produced at a uniform rate after installation of separators. This substantially reduced stuffing-box difficulties.



IN THIS TYPE of bottom-hole separator the oil-gas mixture goes through small eductor pipe to a point above pump seating nipple. It overflows into annulus, where oil enters tubing ports, and gas escapes to surface. Fig. 33.



THESE DYNAMOMETER CARDS show the history of a pumping well before and after installation of a bottom-hole separator. Card A shows the operation when large volumes of gas were going through the pump. The small area of the card shows that very little work was being done. Card B was taken immediately after the bottom-hole separator was installed. The well is pumping normally, with fairly high volumetric efficiency. Card C was taken shortly after card B, and shows that the well has pumped off, resulting in fluid pound. The well was never able to pump off before the separator was installed. Fig. 34.

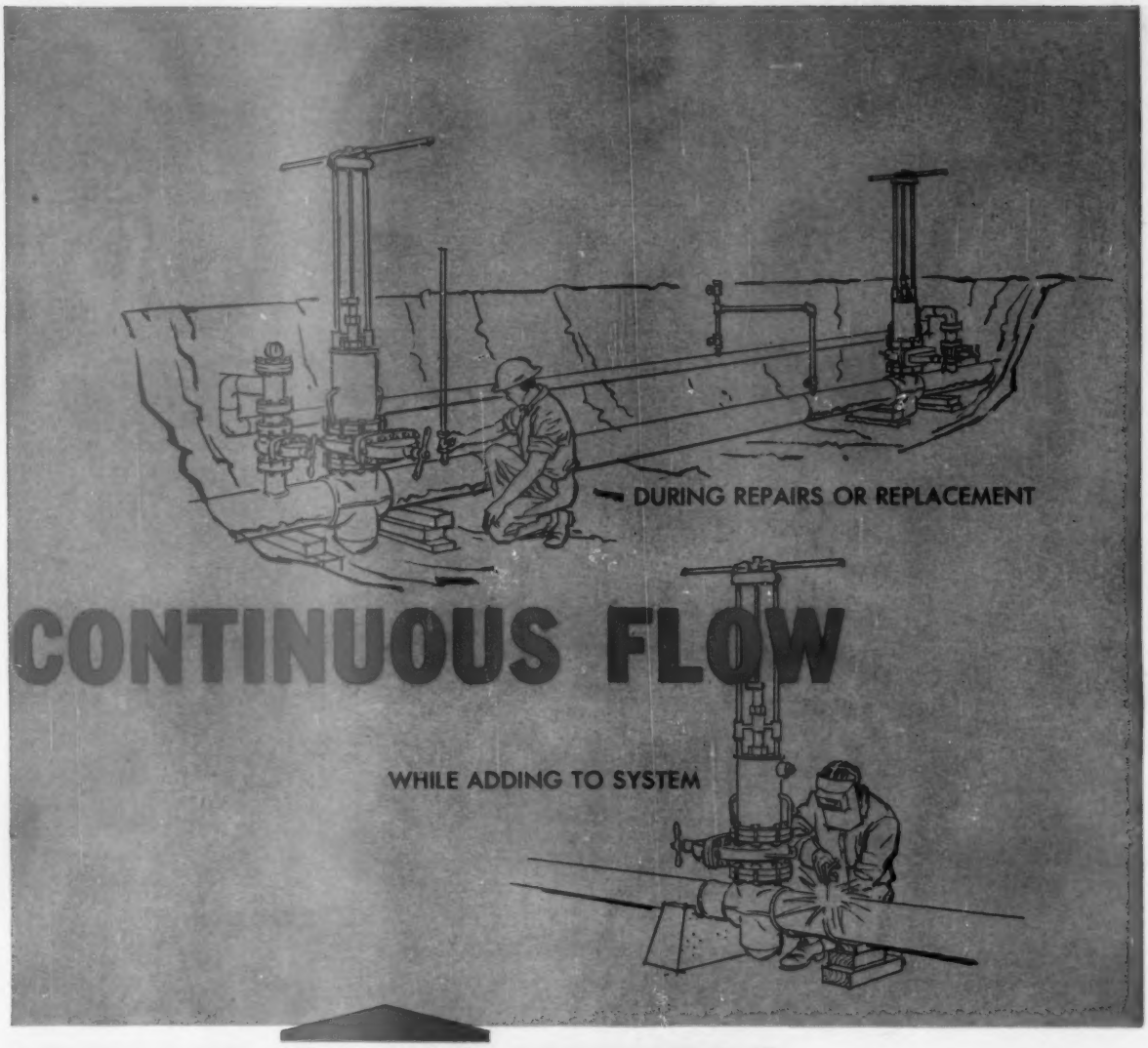
References

1. Bruce H. Robinson, "Economics of Pumping"; Drilling and Production Practice API 1935, p. 91.

2. R. L. Chenault, "Some Factors to be Considered in the Selection and Use of Subsurface Pumps"; Petroleum conference ASME, Houston, 1947.

3. C. J. Merryman, "Field-Constructed Gas Anchors Can Save Money"; World Oil, August 1960.

4. W. P. Schmoe, "Bottom-hole Separators Increase Production"; World Oil, April 1959.



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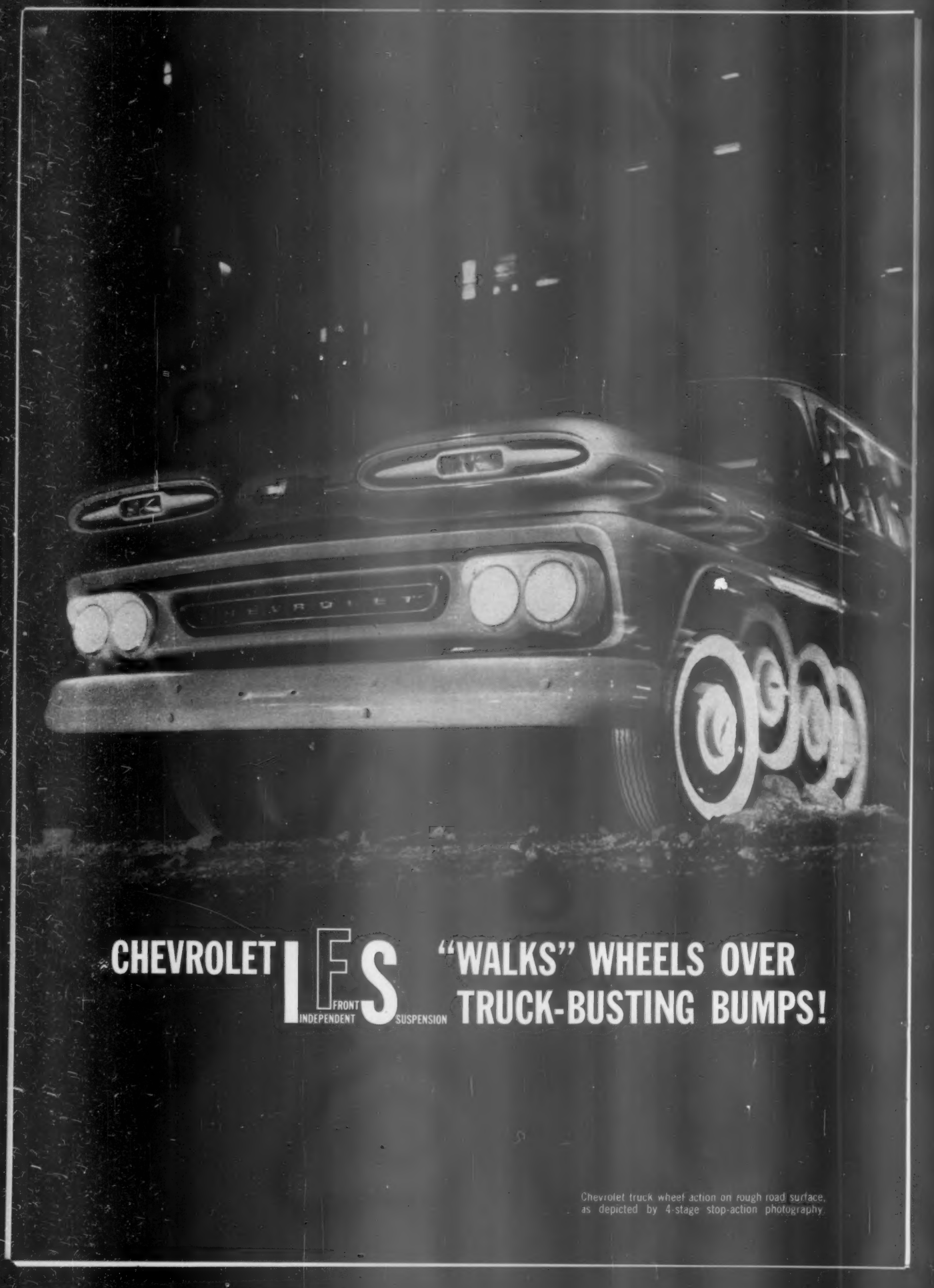

Chevrolet truck wheel action on rough road surface, as depicted by 4-stage stop-action photography.

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That gives you an idea of how Chevy Independent Front Suspension works to move you ahead in the money-making department. And it's available in 165 Chevrolet models for '61, from new Corvair 95's to 36,000-lb. GVW tandems. Check it out with a demonstration ride at your Chevrolet dealer's, sometime soon. . . . Chevrolet Division of General Motors, Detroit 2, Michigan.

INDEPENDENT FRONT SUSPENSION

In Chevy, each front wheel, suspended independently, is free to step cleanly over bumps (see left). Each works smoothly to reduce objectionable jolts so characteristic with I-beam axle design (right). Working with load-tailored rear suspensions in every weight class, I.F.S. provides the basis for profit-protecting performance that's unmatched by I-beam axle trucks.

I-BEAM AXLE DESIGN

1961 CHEVROLET STURDI-BILT TRUCKS

CHEVROLET

BY W. L. NELSON Technical Editor and Petroleum Consultant

Refinery obsolescence costs are not excessive

PROCESS COSTIMATING No. 76, July 25, 1960, p. 204, was a tabulation of the processing changes of the refining industry since 1860. The changes that are thought to have produced a significant degree of obsolescence are tabulated on this page for the purpose of evaluating in future issues of Process Costimating, the loss suffered by the industry through obsolescence.

Obsolescence in the industry has not been severe. Of the 38 changes which involve obsolescence:

Six were primarily additions.

Nine were primarily alternative processes.

Two affected only a few refiners.

Six involved an average of only about 7 years of depreciation.

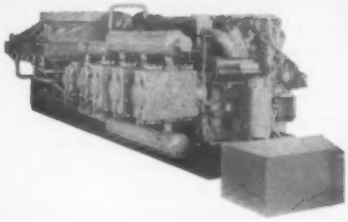
Only about 15 changes may have required the writeoff of about 13 years of depreciation (10-19 years) and even a glance at the more severe cases of obsolescence shows that most of the loss must have been recovered by utilization of the obsolete equipment in the construction of new processes or additional capacity.

Perhaps the most severe obsolescence occurred by the replacement of Burton and Jenkins cracking stills by the reaction-chamber types of cracking processes. Next in importance was the conversion from reaction-chamber cracking processes to the tube-still type of cracking processes. The discarding of acid-treating and rerun equipment (or vapor-phase treating) caused by the introduction of gum inhibitors was extensive but the cost was not great. In recent years, only the replacement of thermal reforming equipment with catalytic reforming equipment has caused large obsolescence costs. Actual costs will be discussed in Process Costimating No. 92, and the large expenditures needed for quality improvement No. 90.

Process Changes That Involve Obsolescence

	Year of recognition‡	Innovation	Replaced or remodeled	Approx. years depreciation to recover†
D	1890	Battery of shell stills	Batch stills (1865)	a
T	1896	Frasch copper desulfurization	Sulfuric acid (1870)	b
D	1915	Towers on shell stills	Battery of stills (1890)	a
L	*1915	Percolation of lube oils	Sulfuric acid treatment (1880)	6
L	*1922	Centrifuge dewaxing	Cold settling (1900)	10
D	*1925	Reaction-chamber cracking	Burton stills (1915)	15
		Reaction-chamber cracking	Jenkins, etc., stills (1920)	17
D	*1925	Two-stage steam plants	Low-pressure boilers (1900)	10
T	1928	Hypochlorite sweetening	Doctor sweetening (1915)	b
L	1928	Clay contacting	Percolation (1915)	b
G	1928	Absorption process	Compression process (1916)	a
D	1930	Gyro vapor-phase cracking (gaso.)	Liquid phase cracking (1925)	b
D	*1930	Pipe stills and towers	Shell-still battery (1915)	12
L	1930	Multiple-hearth burners	Rotary burners (1922)	b
L	*1930	Vacuum distillation	Steam distillation (1912)	10
		Vacuum distillation	Acid and clay treating (1880-1928)	10
T	1930	Gray vapor-phase treating	Acid and rerun (1915)	c
T	*1932	Inhibitors for gum	Gray vapor phase and acid rerun (1930)	19
D	1932	Destructive hydrogenation	Reaction chamber cracking (1925)	c
D	*1932	Delayed coking	Shell still coking (1910)	10
L	*1933	Solvent-extraction processes	Acid and clay treating (1880-1928)	9
G	*1935	Catalytic polymerization	Thermal polymerization (1932)	18
T	1935	Copper chloride sweetening	Other sweetening (1915-1928)	b
G	*1935	Propane recovery	Stabilizers (1930)	17
L	*1935	Solvent dewaxing	Other dewaxing (1891-1922)	8
D	*1935	Tube-still cracking	Other cracking (1925-1929)	16
D	1939	Combination cracking	Pipe-still topping, etc. (1930)	b
G	1940	Recovering several hydrocarbons	Stabilizers (1935)	a
L	1940	Bauxite and clay desulfurization	Sweetening processes (1915-1935)	a
T	1941	Caustic desulfurization	Sweetening processes (1915-1935)	a
L	*1945	Solvent deoiling	Sweating (1891)	2
D	*1945	Catalytic cracking	Tube-still cracking (1935)	15
D	*1952	Catalytic reforming	Thermal reforming (1930)	10
D	1953	Continuous coking	Delayed coking (1932)	b
L	1953	Continuous clay percolation	Other clay treatment (1915-1928)	b
L	*1955	Continuous wax molding	Gray molding press (1891)	2
G	*1955	Alkylation for motor gasoline	Polymerization (1935)	10
T	*1956	Inhibitor sweetening	Other sweetening (1915-1935)	7

*Involving a significant obsolescence cost. †Based on useful life of 20 years. ‡Losses are actually distributed over a number of years. aThe innovation is primarily an addition. bPrimarily an alternate process. cOnly a small segment of industry involved.



Design engineered for gas booster service in the Louisiana Gulf Coast area, this packaged GMXF-10 compressor moves 4.43 MMSCFD. It is rated at 825 bhp. Equipped with Entronic Controls for remote field operation, this unit is a typical example of the efficiency gained by specifying C-B/Southern Packaged Compressor Plants.

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Corrosion tests speeded by ultrasonics

A major advantage of ultrasonics is that no shutdown is needed to take measurements. Material inside the pipe or vessel does not affect measurements as long as its density is not close to that of the pipe or vessel material. Dimensions, mechanical and chemical properties, quality, presence of discontinuities or serviceability can be determined by ultrasonic inspecton.

DOW CHEMICAL CO., at Freeport, Tex., makes 3,200 ultrasonic thickness measurements on a pipe coil in 6 to 7 hours on a routine basis by two operators. The coil is 400 ft. long and made of 2-in. Schedule 80 pipe. The readings are made at 6-in. intervals 90° apart along the pipe.

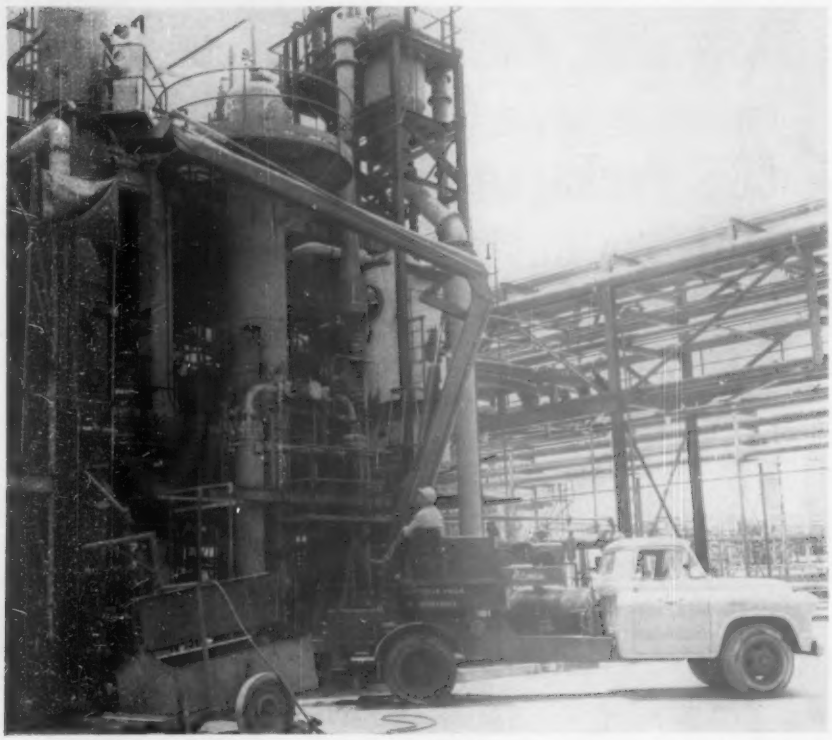
In the first test by the same two operators when the coil was only 300 ft. long, almost 3 days were needed to complete 2,400 readings.

Operator training played an important part in these tests. Operation of ultrasonic test equipment is possible by semiskilled personnel on relatively simple and routine jobs. However, the average job is not routine, and requires the services of an engineer or trained technician.

This use of ultrasonic thickness measurement was revealed by C. E. Lautzenheiser, of Dow's Freeport plant, at the ASME petroleum-mechanical conference in New Orleans.

Lautzenheiser also told the conference that a tower-corrosion survey was made using the Vidigage, Fig. 1, every 30 days for several months to find any change in corrosion rate because of a process change.

Ultrasonic equipment is moderate in price and dependable in operation. The capital cost of the equipment and its operation are justified by showing the difference between usable and nonusable material, by salvage of usable pipe and pressure vessels, and by reducing down time to an absolute minimum.



A TOWER CORROSION SURVEY was made every 30 days for several months to find any change in corrosion rate because of process change. Fig. 1.

Methods of Ultrasonic Inspection

Three methods are used for ultrasonic inspection:

1. A single-frequency sound beam is transmitted through the part.

2. A single-frequency sound beam is reflected from changes of section or discontinuities of the part.

3. The sound-beam frequency is varied to produce resonance.

These methods rely on high-frequency sound to travel through a homogeneous material with little attenuation but be reflected at an interface that has an abrupt density change. The first two methods are used normally for flaw detection and the third to measure thickness.

Normal test frequencies range from 0.5 to 20 mc. (megacycles) per second. Sound waves for testing are produced by piezoelectric crystals or transducers. Stress in a piezoelectric crystal causes a dimension change.

Thus, a 1-mc. alternating voltage applied across a piezoelectric transducer causes it to change dimensions and generate sound waves at the same frequency.

When a transducer is coupled to a test part with an incompressible fluid, any dimensional change causes the transducer to act as a piston and generate compression sound waves in the part.

Table I shows some applications, advantages, and limitations of ultrasonic testing.

Thickness Testing

Resonance is used for thickness testing and will measure thickness from a few thousandths of an inch up to 12 in. with material of good sound-transmitting properties. Accuracy is usually within 0.1 to 3%.

The pulse-echo technique may be used for thickness measurements with an accuracy of ±5%. It is used usually when the thickness is greater than 1 in. The lower limit of thickness is about ⅛ in.

Instruments. Portable, manually op-

PORTABLE, manually operated instrument that uses dry cells for power, the Audigage. Fig. 2.

FLAW DETECTION of a large bolt from a steam turbine is done with a pulse-echo instrument. Fig. 3.

erated instruments are available that use dry cells for power and weigh from 5 to 30 lb. These are useful when measurements are made at scattered locations. Fig. 2 shows the Audigage. Thickness is calculated from instrument readings; however, a new transistorized model reads thickness directly.

Electronic instruments use a cathode-ray tube presentation calibrated directly in thickness. These need 110-volt a.c. power and weigh 70 lb. or more, Fig. 1. It is used where a large number of measurements are needed in a small area. The transducer of one instrument may use extension cables up to 1,000 ft. long.

How it works. Ultrasonic resonance uses continuous, compression waves transmitted into a test part from one side. Frequency, and thus wave length, is varied until a wave is twice reflected and leaves the first surface in phase with another incoming wave. Standing waves are then set up within the part, causing it to resonate.

Resonance is indicated by its loading effect on the transducer applying the ultrasonic sound waves.

When the fundamental resonant frequency is found, either directly, or as the difference between two harmonic frequencies, the thickness of the test part may be calculated. The fundamental resonance frequency in the thickness direction of a plate is:

$$F = V/\lambda = V/2T = K/T \quad (1)$$

Where:

F = fundamental frequency, mc.

V = sound velocity, million in. per second.

Table 1-Applications, Advantages, and Limitations of Ultrasonic Testing

Applications

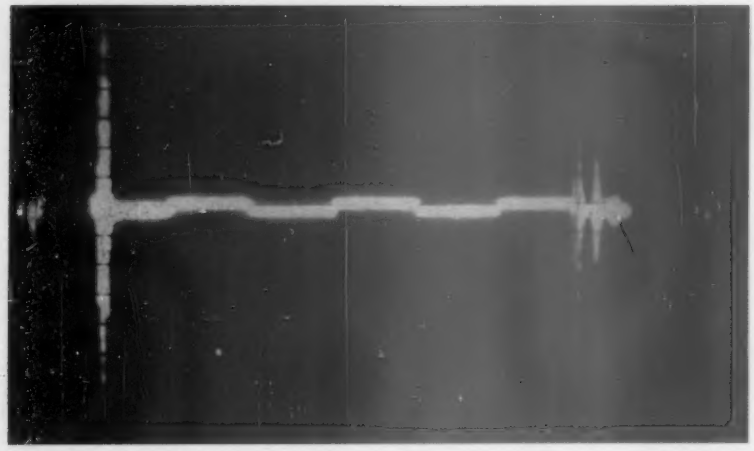
1. Flaw detection.
2. Thickness measurements.
3. Rate of growth of fatigue cracks.
4. Detection of bore-hole eccentricity.
5. Measurement of elastic moduli.
6. Control of weld quality.
7. Investigation of corrosion rates.
8. Metallurgical research relating to structure.
9. Inspection of grinding wheels, ceramics, and concrete.

Advantages

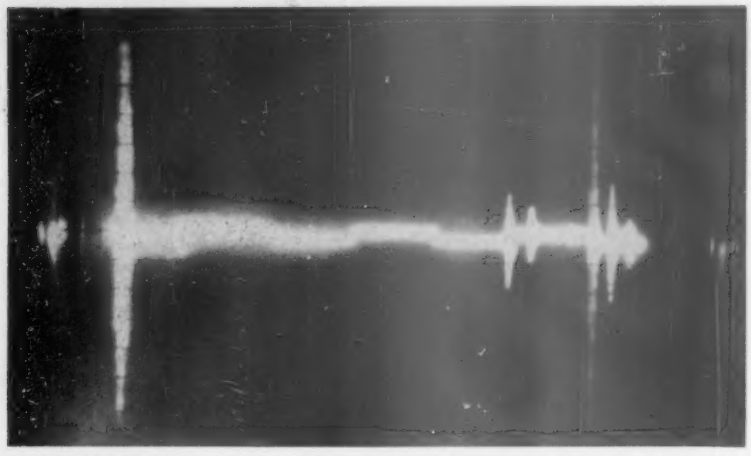
1. High sensitivity.
2. Great penetrating power.
3. Accuracy.
4. Fast response permitting rapid and automated inspection.
5. Need for access to only one surface of the specimen.

Limitations

1. Unfavorable part geometry; size, contour, complexity, and defect orientation.
2. Undesirable internal structure; large grain size, porosity, and inclusions.
3. A skilled operator is required.



EACH HORIZONTAL BAR represents 3 in. of steel. The large pip on the left is due to a transducer "ringer." The pip on the right is echo from the end of the bolt. Fig. 4.



A SAW CRACK 1/16 in. deep simulates a crack in the same bolt. The pip from the crack is the one five bars, or 15 in., from the end. Fig. 5.

T = thickness, in.
K = constant, million in. per second.
λ = wave length of sound, in.

Sound velocities in most solids range between 90,000 and 350,000 in. per second.

Plate thickness can be measured from one side by finding the fundamental resonate frequency or two adjacent harmonic frequencies.

$$T = K/F = \frac{K}{nF - (n-1)F} \quad (2)$$

where nF and (n − 1) F are any two adjacent harmonics.

The thickness of any material may be measured that will transmit sound. It includes most metals, glass, ceramics, and rigid plastics at frequencies of 250 kc. to 25 mc. Some cast metals with large grain size on numerous inclusions may be difficult to test. Wood, concrete, soft rubber, and similar materials require low ultrasonic frequencies of the order of 20 to 200 kc.

Transducers are available for temperatures up to 500° F. The front and back surfaces of the test part must be substantially parallel. Taper to 1° to 2° can be tolerated, however. If surface roughness of either side exceeds about one-half wave lengths, indications will be weak or nonexistent.

The shape of the part has an effect on transducer selection. Pipe that is 2 in. and larger may be tested using flat transducers. Below 2 in., grind the transducers to the curvature of the pipe. The smallest diameter that Dow has measured is ⅜-in.-o.d. by ⅛-in.-wall tubing. Measurements by others have been made on ⅛-in.-o.d. tubing.

Flaw Detection

Almost all flaw-detection techniques used a pulsed sound beam. The instrument excites the transducer for a few microseconds with a repetition rate of about 60 c.p.s. The transmitted and received signals are displayed on a cathode-ray tube. Time delay may be adjusted so that a length of 6 to 60 ft. may be shown on the tube.

Two basic techniques may be used for pulsed testing:

1. Through transmission uses separate transducers for transmitter and receiver.

2. Reflection or echo uses one transducer as both transmitter and receiver or separate transducers for each function. It is more widely used.

These may be used in two methods of testing:

1. Immersed method. The test part is immersed in a liquid, usually water, with an appreciable distance between the transducer and test part.

2. Contact method. The transducer is coupled to the test part with a thin liquid film.

Flaw instruments. The Texas Division of Dow Chemical Co. uses the Sperry Reflectoscope, a pulse-echo instrument for flaw detection. It is shown testing a large bolt from a steam turbine, Fig. 3. The bolt is 18 in. long, with 3 in. of threads on each end.

Flaw detection. The cathode-ray tube is adjusted so that the time for sound to travel about 21 in. through steel will fill the screen, Fig. 4. The marker bars are set so each horizontal bar represents 3 in. of steel. The large pip on the left is due to transducer "ringing". The crystal cannot stop vibrating instantaneously and the ringing is an initial pulse. The next large pip to the right is the echo from the end of the bolt. The smaller pips at right are internal sound reflections within the bolt.

A saw cut ⅛ in. deep simulates a crack, in the same bolt, Fig. 5. The pip from the crack is the one five bars, or 15 in., from the left end.

The Texas Division operates 18 power turbines. The turbine rotors, generator rotors, casing bolts, and babbitt bearings are ultrasonically checked each overhaul. These tests detect defects before they become large enough to cause failure. Also, Dow tests bar stock and other raw materials to eliminate machining and installing defective material in high-pressure and/or high-quality machinery.

Reliability of ultrasonic flaw detection is dependent entirely upon the person operating the instrument. Defect interpretation is dependent upon operator skill and experience. Automation and preset alarms are not practical on normal maintenance jobs.

Photographed at American Oil Co., (Wood River, Ill., Refinery)

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Basic in catalyst chemistry

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31. How to find reservoir-oil properties from laboratory fluid-analysis data

BY E. T. GUERRERO
and
F. M. STEWART

GIVEN: Laboratory fluid-analysis data on a subsurface oil sample from the discovery well of a pool. The middle of the producing formation was at 6,700 ft. and the initial reservoir pressure was measured as 3,000 psi. From the pressure chart an initial gradient of 0.300 psi. per ft. was found. The basic fluid-analysis data are in Table 2 and the first six columns of Table 1.

FIND: Using the fluid-analysis and bottom-hole-pressure data given determine:

1. Initial saturation conditions of pool.
2. Expansibility factor for the oil at 3,000 psi. and 150° F.
3. Variation with pressure at reservoir temperature of the following:
   (a) Relative-volume factor.
   (b) Two-phase formation-volume factor.
   (c) Single-phase oil formation-volume factor.
   (d) Solution gas-oil ratio.
   (e) Viscosity.
   (f) Y factor.
4. Single-phase oil formation-volume factors at bubble-point pressure for flash and differential liberations.
5. Single-phase formation-volume factor at initial reservoir conditions using subsurface-pressure data, specific gravity of gas, and °API gravity of oil.

METHOD OF SOLUTION: These equations will be used in the solution of the problem.

$$C_o = \frac{1}{V}\frac{dV}{dp} \approx \frac{V_2 - V_1}{V_1(p_1 - p_2)} \quad (1)$$

$$B_t = (V_{og}/V_{sat})\, B_{ob} \quad (2)$$

$$Y = \left(\frac{p_b - p}{p\left(\frac{V_{og}}{V_{sat}} - 1\right)}\right) \quad (3)$$

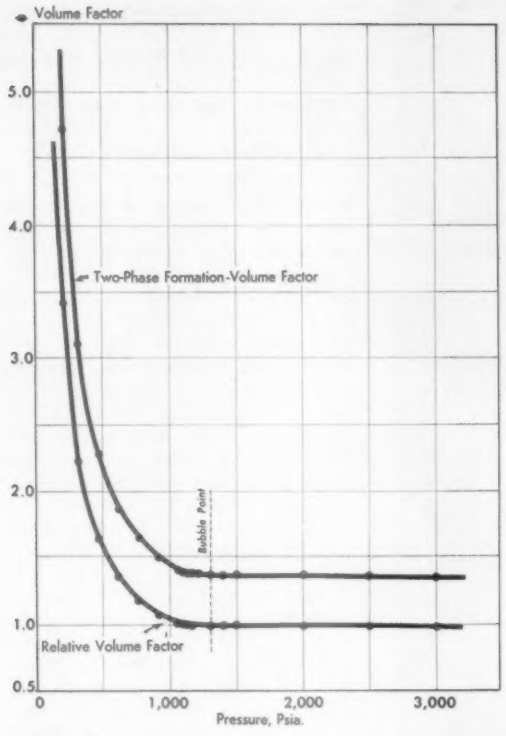
TABLE 2—FLUID-SEPARATOR TESTS

(1) Separator pressure, psig.	(2) Gas-oil ratios, std. cu. ft. per st.-tk. bbl. Separator	(3) Total	(4) St. tk. gravity, °API	(5) Bubble point formation vol. factor V_{sat}/V_s	(6) Sp. gr. of flashed gas	(7) Separator temp., °F.
0	463	463	42.2	1.339	1.162	68
37	368	413	43.8	1.239	0.963	68
72	315	406	44.0	1.235	0.891	68
115	290	413	44.4	1.241	0.847	68
Differential	...	524	43.8	1.386	....	..

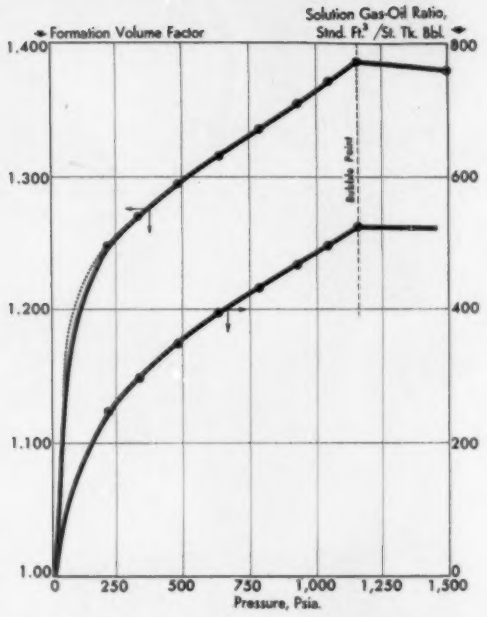
TABLE 1—SUBSURFACE FLUID-ANALYSIS DATA AND CALCULATIONS

(1)	Measured data					Calculations				
	(2) Flash liberation	(3) Flash liberation	(4) Differential liberation at 150° F.	(5) Differential liberation at 150° F.	(6) Differential liberation at 150° F.	(7)	(8)	(9)	(10)	(11)
Press., psia.	Relative vol. factor at 150° F., V_{og}/V_{sat}	Viscosity of oil at 150° F. Cp.	Gas liberated, std. ft.³/s.t. bbl.	Gas in solution, std. ft.³/s.t. bbl.	Formation vol. factor, V_o/V_s	Two-phase formation vol. factor	$p_b - p =$ 1,155 − (1)	$\frac{V_{og}}{V_{sat}} - 1$ (2) − 1	$p\left(\frac{V_{og}}{V_{sat}} - 1\right)$ (1)×(9)	Y (8)÷(10)
5,015	0.9635	0.94	...	...	.....	1.3357	....	.....	.....	....
4,165	0.9700	0.88	...	...	1.3447	1.3447	....	.....	.....	....
4,015	0.9712	0.87	...	...	.....	1.3464	....	.....	.....	....
3,015	0.9798	0.79	...	...	.....	1.3583	....	.....	.....	....
2,515	0.9847	....	...	...	.....	1.3651	....	.....	.....	....
2,015	0.9897	0.74	...	...	.....	1.3720	....	.....	.....	....
1,515	0.9953	....	...	...	.....	1.3798	....	.....	.....	....
1,415	0.9965	....	...	...	.....	1.3814	....	.....	.....	....
1,315	0.9978	....	...	...	.....	1.3833	....	.....	.....	....
1,215	0.9992	0.70	...	...	.....	1.3852	....	.....	.....	....
1,155	1.0000	0.70	0	524	1.3863=B_{ob}	1.3863	0	0	0	....
1,145	1.0025	....	...	...	.....	1.3898	10	0.0025	2.8625	3.493
1,135	1.0051	....	...	...	.....	1.3934	20	0.0051	5.7885	3.455
1,115	1.0111	....	...	...	.....	1.4017	40	0.0111	12.3765	3.232
1,105	1.0142	....	...	...	.....	1.4060	50	0.0142	15.6910	3.187
1,085	1.0213	....	...	...	.....	1.4158	70	0.0213	23.1105	3.029
1,045	.....	0.71	28	496	1.3712	.....	110	.....	.....	....
935	1.0858	0.72	56	468	1.3549	1.5052	220	0.0858	80.2230	2.742
785	1.1879	0.74	90	434	1.3359	1.6468	370	0.1879	147.502	2.508
635	1.3536	0.79	131	393	1.3148	1.8765	520	0.3536	224.536	2.316
485	1.6527	0.85	175	349	1.2957	2.2911	670	0.6527	316.560	2.117
335	2.2418	0.98	226	298	1.2726	3.1078	820	1.2418	416.003	1.971
215	3.4100	1.08	275	249	1.2490	4.7273	940	2.4100	518.150	1.814
15	.....	1.38	524	0	1.0458	.....	1,140	.....	.....	....

V_{sat} = volume reservoir oil at 1,155 psia. at 150° F.
V_s = Stock-tank-oil volume at 14.7 psia. at 60° F.
V_{og} = volume at given pressure and 150° F. of oil plus liberated gas.
V_o = volume at given pressure and 150° F. of oil only.



PRESSURE-VOLUME relations at reservoir temperature. Fig. 1.



VARIATION of formation volume factor and solution gas-oil ratio with pressure at reservoir temperature. Fig. 2.

$$\text{Sp. gr.}_{60/60} = \frac{141.5}{131.5 + {}^\circ\text{API}} \quad (4)$$

$$\text{Mole. wt.}_{(\text{gas})} \approx \text{Mole wt.}_{(\text{air})} \times \text{sp. gr.}_{(\text{gas})} \approx 28.8 \times \text{sp. gr.}_{(\text{gas})} \quad (5)$$

$$B_o = \frac{\rho_o\, 350 + R_{sb}\,(M_g/379)}{(5.615)\,(144)\,(dp/dh)} \quad (6)$$

Where:

c_o = expansibility factor of oil, vol./vol./psi.

V = volume at given pressure and reservoir temperature, bbl.

V_{og} = volume at given pressure and reservoir temperature of oil and liberated gas, bbl.

p = pressure, psi.

B_t = two-phase formation-volume factor, reservoir pore space occupied by 1 bbl. stock-tank oil and its initially dissolved gas at reservoir conditions.

V_{sat} = volume of reservoir oil at bubble-point conditions, bbl.

V_s = stock-tank-oil volume at 14.7 psia. and 60° F., bbl.

B_{ob} = single-phase oil formation-volume factor at bubble-point pressure and reservoir temperature.

Y = factor defined by Equation 3.

p_b = bubble-point pressure, psia.

B_o = single-phase oil formation-volume factor at pressure p and reservoir temperature.

ρ_o = density of oil at 14.7 psia. and 60° F., g./cc. = sp. gr.

R_{sb} = solution gas-oil ratio at bubble-point conditions, std. cu. ft./st. tk. bbl.

M_g = molecular weight of liberated gas.

dp/dh = gradient at reservoir conditions, psi./ft.

350 = density of water at 4° C. and atmospheric pressure, lb./bbl.

379 = std. cu. ft. of gas per lb. mole at 60° F. and 14.7 psia.

5.615 = cu. ft. in 1 bbl.

144 = sq. in. per sq. ft.

SOLUTION:

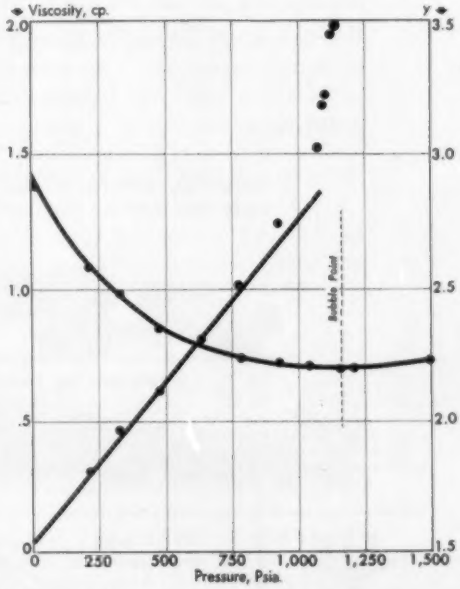
1. Relative volumes are normally listed such that the bubble-point volume is unity. Note in Table 1, column 2, that in this case the bubble point occurs at 1,155 psia. Since the initial reservoir pressure was measured as 3,000 psi. then the pool was undersaturated at initial pressure.

2. Using the relative volume factors (Table 1, column 2) at 4,015 psia. (V_1) and 2,015 psia. (V_2) the oil expansibility factor at 3,000 psi. and 150° F. is given by

$$C_o = \left(\frac{1}{0.9712}\right)\left(\frac{0.9897 - 0.9712}{4,015 - 2,015}\right) = \frac{0.0185}{(0.9712)\,(2,000)} = \frac{0.0185}{1,942.4}$$

$$= 9.524 \times 10^{-6}\ \frac{\text{bbl.}}{\text{bbl. psi.}}$$

or vol./vol./psi.



VARIATION of viscosity and Y factor with pressure at reservoir temperature. Fig. 3.

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". . . formation-volume factor decreases and the oil gravity increases as the separator pressure increases."

A similar calculation for the expansibility from initial pressure of 3,015 psia. down to the bubble point, 1,155 psia., gives $C_o = 11.08 \times 10^{-6}$ vol./vol./psi. The different result is to be expected as expansibility of oil above the bubble point is not exactly a straight line function with pressure.

3. See Figs. 1, 2, and 3.

4. Single-phase oil formation - volume factors at the bubble-point pressure are obtained for differential and flash liberations from Tables 1 and 2.

Type liberation	Formation vol. factor
Differential	1.386
Flash	1.339

5. Using a gas specific gravity of 1.162 and oil gravity of 42.2 (Table 2)—

$$\text{Sp. gr. oil}_{(60/60)} = \frac{141.5}{131.5 + 42.2}$$

$$= 0.8146$$

This is the specific gravity of the oil at 60° F. and atmospheric pressure compared to water at 60° F. and the same pressure. It can be related to water at 4° C. (39° F.) by multiplying by 0.999 or atmospheric pressure.

$$\rho_o = \text{sp. gr.}_{(\text{oil})} = 0.8146 \times 0.999$$
$$= 0.814$$

$$M_g = 28.8 \times 1.162$$
$$= 33.5$$

$$B_o = \frac{(0.814)(350) + [(524)(33.5) \div 379]}{(5.615)(144)(0.30)}$$

$$= 1.36$$

DISCUSSION: In the solution of the material balance, volumetric and frontal-advance equations, and most reservoir engineering problems, fluid properties are required. This problem illustrates the most widely used method of obtaining oil properties. Procedure involves securing representative subsurface samples of the oil early in the life of a pool.[1] This will make possible the definition of the properties from initial reservoir conditions. Normally it is advisable to obtain several samples at different structural positions in the reservoir. These are ana-

lyzed in the laboratory for the variation with pressure (at constant temperature) of oil volume, viscosity, gas in solution, and formation-volume factor. Columns 1 through 6 of Table 1 and Table 2 show the measured data.

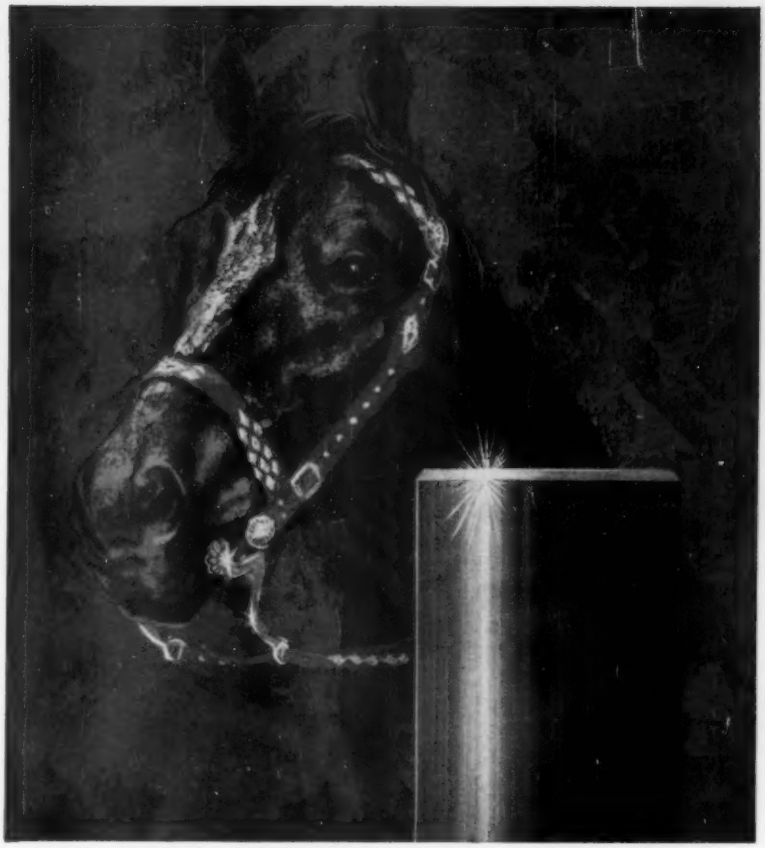
In columns 2 and 3 of Table 1 flash liberation was involved, whereas in columns 4, 5, and 6 differential liberation was used. The two liberation processes differ in that in the former the gas evolved from solution is kept in contact with the oil during the entire liberation process. In the differential process gas evolved from solution is removed from contact with the oil after each pressure decrement. Actually the two processes give different results. For most nonvolatile crudes flash liberation gives higher oil viscosity, formation - volume factor, solution gas-oil ratio, and lower API gravity. But, in most instances this difference is not appreciable and can be neglected.

It is well to remember that the liberation that occurs between the reservoir rock and stock tank is a combination of flash and differential. Also, the resulting fluid properties are used with other data (rock properties and sand volumes) that are apt to be less accurate.

Note from Equation 2 and Fig. 1 that the relative volume factor for oil plus gas (V_{og}/V_{sat}) and the two-phase formation volume factor B_{ob} (V_{og}/V_{sat}) differ only by a constant multiplier. Above the bubble point only undersaturated liquid is present and these factors increase slightly as the liquid expands with decreasing pressure. Below the bubble point both liquid and free gas occur. As the pressure decreases the liquid portion shrinks while the free-gas portion increases and expands.[2]

The increase of the latter is much larger than the shrinkage of the former and this accounts for the growth of the oil and gas volume factor below the bubble-point pressure. In contrast, the single-phase oil formation-volume factor (V_o/V_s) decreases below the bubble point as shown in Fig. 2. Above the bubble point it becomes similar to the two-phase curve since both represent only liquid in this region.

Increasing pressures cause gas to go into solution with oil. This process continues as long as free gas is available. At the bubble point all the free gas is in solution and the solution gas-oil ratio remains constant for pressures above this point, Fig. 2. Note in Figs. 2 and 3 that increasing amounts of gas in solution have a net effect of increasing the single-phase formation volume factor and decreasing the oil viscosity. As pressure is in-



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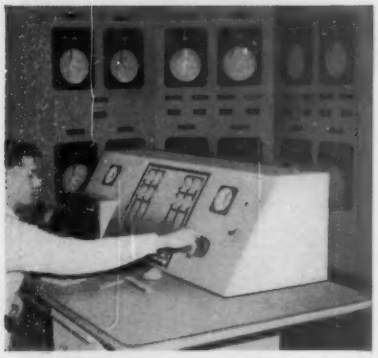

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creased above the bubble point the liquid is compressed and viscosity increases.

Equation 3 defines the Y factor which is computed for pressures below the bubble point and plotted in Fig. 3. It is an empirical factor which gives a linear graph when plotted against pressure for systems composed almost entirely of hydrocarbons. It is very sensitive at pressures near the bubble point. And it is useful for smoothing and averaging pressure-volume data.

All of the measured data of Table 1 were obtained at reservoir temperature. Table 2 shows data obtained at separator temperature. Note that the zero separator pressure formation-volume factor and solution gas-oil ratio of Table 2 are not too different from the comparable bubble-point data of Table 1. This is typical for comparatively nonvolatile crudes. However, large differences may be noted in more volatile crudes.

The principal purpose of the data in Table 2 is to assist engineers in the selection of separator pressures. Note that the formation-volume factor decreases and the oil gravity increases as the separator pressure increases. The large change occurs between 0 and 50 to 75 psi. separator pressures. Decreasing the formation-volume factor increases stock-tank-oil recovery; and increasing the oil gravity (below 40° API) increases the value of the oil.

The properties of oil and gas mixtures are primarily functions of pressure, temperature, composition of gas, and composition of oil. No satisfactory analytical relations have been found to define these properties.[2] They must be determined by laboratory measurement. For those cases where samples of the reservoir fluid were not obtained early in the life of a pool, fair estimates of the fluid properties can be obbtained from empirical correlations and a knowledge of reservoir pressure, temperature, gas gravity, and oil gravity.[3,4]

Acknowledgment

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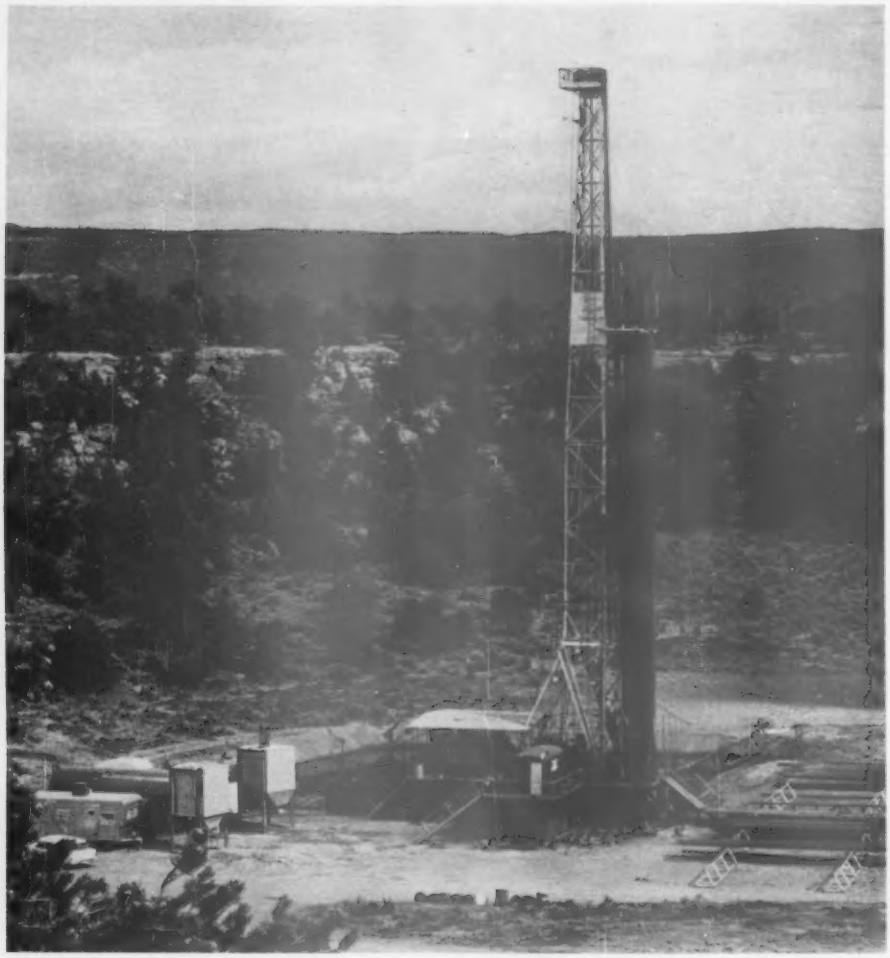


GREAT WESTERN'S RIG 7 had to abandon air drilling when oil-weep zone stuck pipe. Using 50% oil-emulsion fluid overcame sticking problem and kept drilling rates high, frequently as fast as with air.

Utah well clicks with 60% oil-emulsion mud

BY J. N. SMITH
Mud Engineer,
Great Western Drilling Co.,
Midland, Tex.

HOW MUCH OIL can be used effectively in an oil-in-water emulsion drilling fluid? A recent experience of Great Western Drilling Co. helps answer the question.

On 2 Book Cliffs in Grand County, Utah, Great Western used sufficient oil to produce a 52% oil emulsion while trying to free stuck pipe.

After getting the drill pipe free, drilling continued at a fast rate with an emulsion containing as much as 60% oil.

Three important conclusions can be drawn from these results:

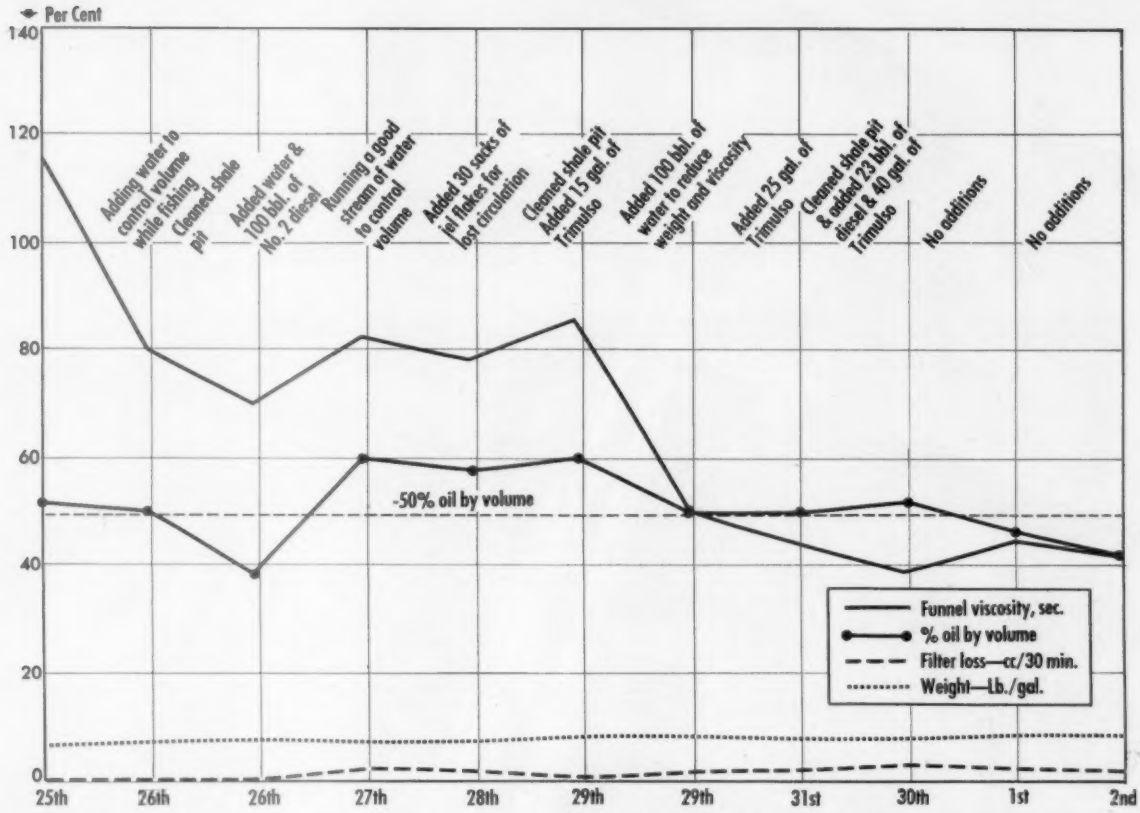
1. Modern emulsifiers are capable of maintaining an emulsion even when oil concentrations run well over 50%. Seldom in the past has it been possible to carry oil concentrations so high and make them effective.

2. The light weight and good flow properties of the high-emulsion fluids can save money in lost-circulation areas. Mud cost on the 2 Book Cliffs was only one-fourth as much as that on nearby wells where circulation is often lost with conventional fluids.

3. From a rate-of-penetration standpoint, the high-oil emulsions will produce good results. In the 2 Book Cliffs, drilling rate with the emulsion fluid was often as high as it had been previously drilling with air.

Oil-weep zone. Great Western's Rig 7 was drilling the 2 Book Cliffs with air when, at approximately 1,800 ft., pressure built up and returns dropped off. Seep oil and cutting completely shut off the air and soon stuck the drill pipe. In an effort to free the pipe before resorting to washover, 20 bbl. of oil was pumped through the drill pipe. An additional 30 bbl. was spotted through the fillup line. Including seepage, there was an estimated 75 bbl. of oil in the hole when mud was made up for the washover operation.

Mud in the pit was made of 100 bbl. of water, 60 bbl. of 38° API



ELEVEN-DAY HISTORY of Great Western's emulsion fluid shows oil content 52% at the outset and later reaching 60%. This was not an invert emulsion; it was oil-in-water emulsion with no free oil in pits. Notice good viscosity, weight, and water loss.

lease crude, 165 gal. of Trimulso emulsifier (produced by Aquaness department, Atlas Powder Co.) and 30 bbl. of emulsifier - oil - water mixture which had been prepared to spot in the hole. This emulsifier mixture contained 10 bbl. of oil and 15 gal. of emulsifier. Three sacks of CMC were added to increase viscosity.

The mixture was made by running water and emulsifier into the pit. This was circulated through the guns while mixing CMC through the hopper at a rate of 20 minutes per sack. Oil was added through the pump suction while pumping the mixture of CMC emulsifier and water through the pit guns.

TABLE 1—WELL DATA, 2 BOOK CLIFFS

Pump	NSCO-C-250-15 in.
Hole	8¾-in.
Drill pipe	3½-in.
Pump speed	59-s.p.m.
Liners	6-in.
Annular velocity	137 ft. per min.
Gage pressure	850 psi.
Kelly hose	3-in.
Stand pipe	4½-in.
Casing	176 ft.—13⅜-in.
Circulation rate	360 g.p.m.
Makeup water:	
	21 cp. per minute calcium.
	500 p.p.m. chlorides.

Good flow properties. Before it was pumped into the hole, the mud in the pit had a viscosity of 117 seconds and a weight of 7.8 lb. per gal. with a zero filter loss. It contained 52% of oil by volume and 0.8 lb. of CMC per bbl. Flow properties of this fluid proved to be excellent. Pressure loss was low and a maximum of hydraulic horsepower was available at the bit. Table 1 summarizes the well, rig, and mud data at the time. Table 2 shows hydraulics.

Viscosity subsequently dropped to 90 seconds when water was added to maintain volume while fishing.

The mud had a homogeneous yellow-green color and showed no signs of separation of free oil.

TABLE 2—HYDRAULICS

Critical velocity—11.7 ft. per second or 702 ft. per minute.

Annular velocity—2.3 ft. per second or 137 ft. per minute.

	Psi.
Drill-collar pressure loss (o.d.)	11
Drill-collar pressure loss (i.d.)	104
Drill-pipe pressure loss (i.d.)	552
Pressure loss-surface equipment	23
Pressure loss across bit (regular)	103
Total pressure losses	804

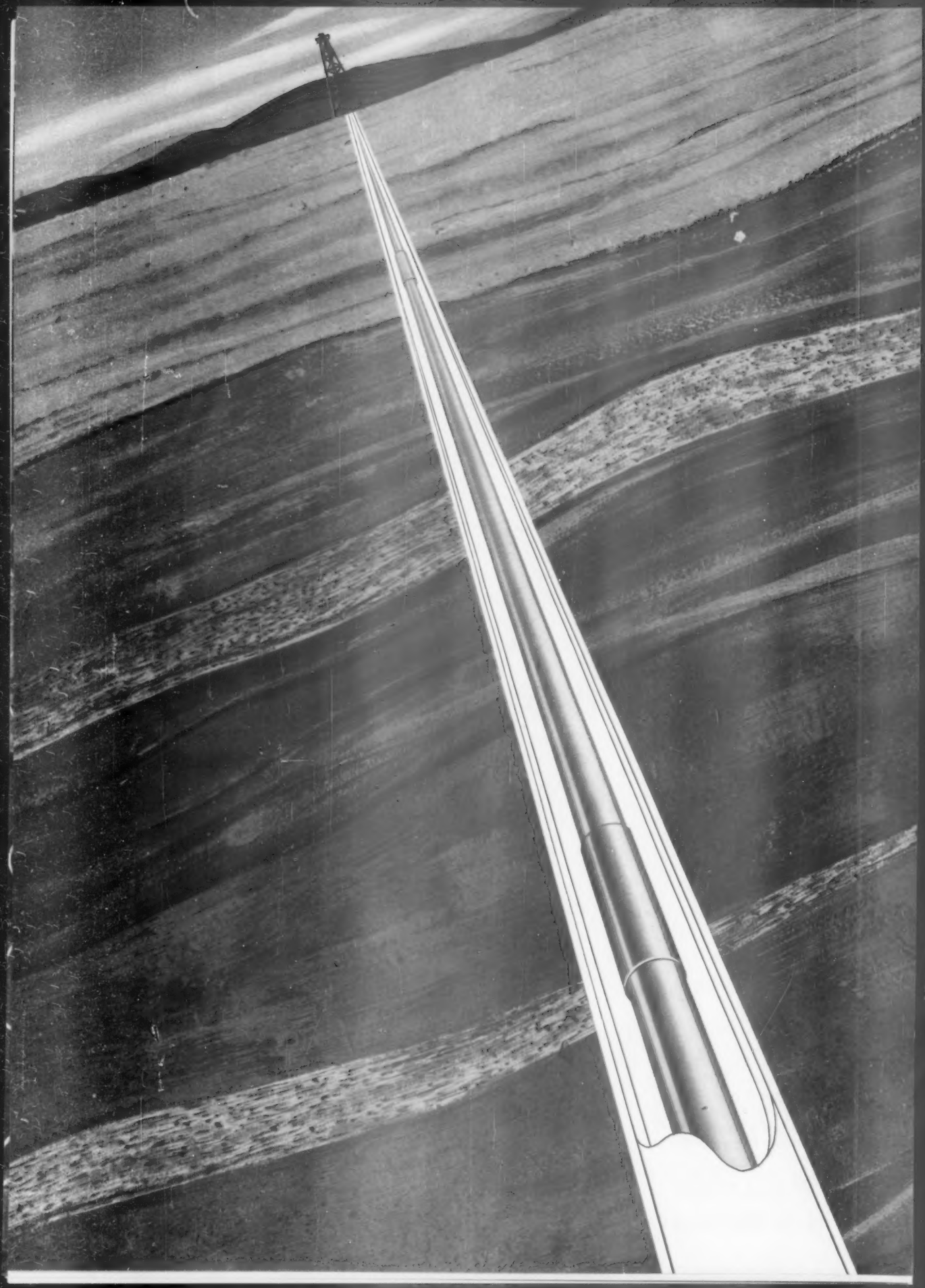
Per cent of pressure loss:

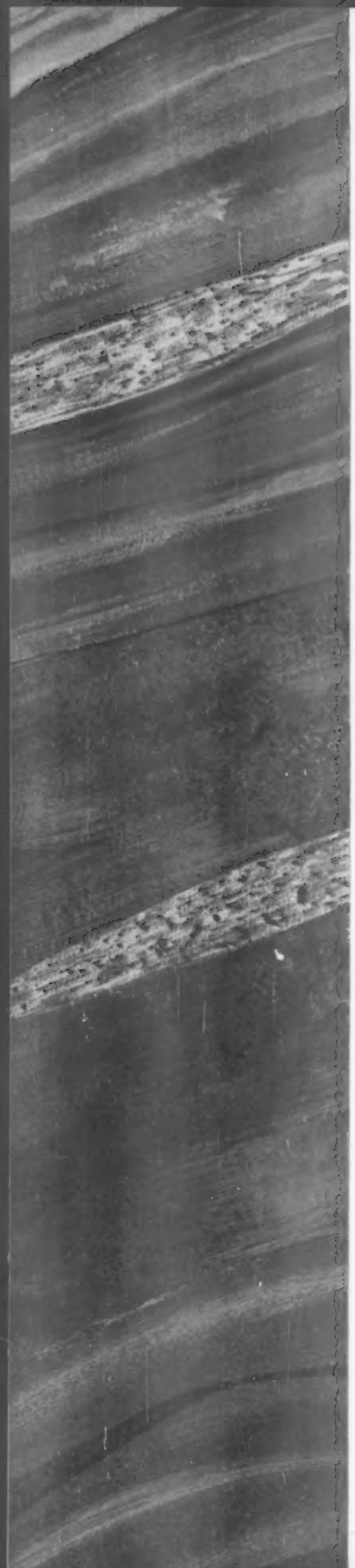
Drill pipe	84.45
Across bit	12.81
Annulus	2.74

Circulating density—8.17 lb. per gal.

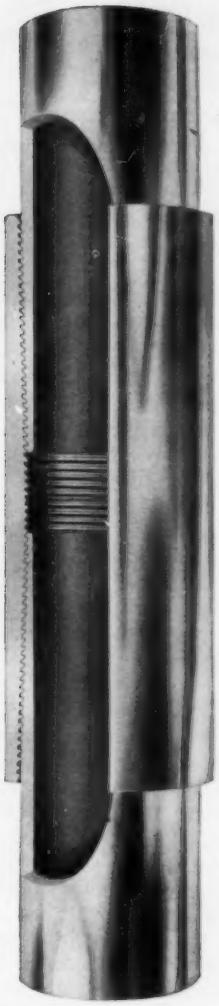
Drilling continues. Following the fishing job, drilling proceeded to total depth of 3,056 ft. When a core barrel was run in to cut the first core at 2,271 ft. in the upper Dakota, the hole was found to be in perfect condition with no drag and no fillup.

Severe loss of circulation with conventional muds is predominant in this area. No loss of circulation was encountered with this high - oil - content fluid. Considering the rapid rate of penetration and the relatively low cost of the drilling fluid, the high-oil-content fluid drilled a cheaper hole than previously drilled with air. In areas that are similar to the 2 Book Cliffs where oil seepage is a known threat in air drilling, Great Western regards oil-in-water emulsions as good insurance against the high cost of fishing.





Something new in the oil country



USS National Buttress-Thread Tubing

National Tube, developer of Buttress-Thread Casing, now introduces Buttress-Thread Tubing.

This new joint has tensile strength comparable to that of the body of the tubing. Since there is no upset, you get maximum hole clearance and less interference when running. Rugged, flat-crested threads have good stabbing characteristics, better resistance to joint damage and faster make-up. Buttress-Thread Tubing has extended life in service because it can be threaded in the field at authorized machine shops. Tin-plated coupling threads offer you gas-tight joints and reduce your make-up torque. For complete information on Buttress-Thread Tubing, write or call National Tube Division, United States Steel, 525 William Penn Place, Pittsburgh 30, Pennsylvania.

USS and National are registered trademarks

USS National Tube Division of United States Steel

Columbia-Geneva Steel Division, San Francisco, Pacific Coast Distributors
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This mark tells you a product is made of modern, dependable Steel.

PART 3
(CONCLUSION)

How to get better lubrication

BY O. H. MOORE
Director, Operating Research,
Tennessee Gas Pipeline Co.

MODIFICATION of equipment is one way to improve engine lubrication. There are other ways, also. Ways that, in themselves, may contribute less but which, at the same time, are less drastic. These include:

Keep systems clean. Good housekeeping and mechanical maintenance of the lubricator system cannot be ignored. Merely adding clean oil to a lubricator does not insure a clean system. Reservoirs should be kept clean and the lubricator in top operating condition.

Pulling lubricators may show the presence of sludge, water and rusty parts. Examination of the ball check valves may show only one ball check where two are needed. It may also show that the wrong size is in use.

Lubricator drive. Checking the lubricator drive is important. The r.p.m. of the lubricator shaft should be determined and steps taken to insure that it remains constant. Many units, equipped with ratchet drives, vary as much as 100% in r.p.m. on similar units in the same plant.

On one type of engine, the lubricator drive is actuated by the eccentric on the timing-gear drive. When the timing-gear drive is replaced, there is a change in the lubricator drive. An increase of ⅛-in. in the diameter of the eccentric gear will increase the r.p.m. 100%.

A positive drive through a gear arrangement is the most satisfactory type.

Pressure. A compression chamber was built to test pumps against pressures up to 1,000 lb., with the chamber pressured with nitrogen The effect of pressure on delivery rates is shown in Fig. 1. After numerous tests, a correction chart (Fig. 2) was prepared. It shows the additional strokes needed at a given pressure to compensate for the reduction in pump efficiency.

This is the third of a three-part series on engine lubrication. It gives a number of steps that can lead to better operation. Previous installments recommended equipment modification. Various types were mentioned with no single type or make singled out as being inferior or superior.

Oil temperature. The effect of delivery rates against atmospheric pressure with the oil temperature at 80° F. and 140° F. varied about 3%. This is in line with the temperature cubical coefficient of expansion.

Low-oil-temperature tests will be made but it is felt that this will be a problem regardless of the type of pump or method of control. No pump will operate satisfactorily if the oil temperature drops to the point where it affects the proper filling of the pump bore on the suction stroke. These are possible solutions: Use of crankcase oil as makeup to the reservoir, use of heater elements within the reservoir box or larger delivery rates through the use of distribution blocks within the force feed lubrication system.

Distribution blocks. The loss of pump prime when operating at low delivery rates is a constant problem. Lubricator pumps of smaller plunger diameter were tried without success. The next attempt was the use of divider blocks in the force-feed lubricator system. These blocks were first laboratory-tested for accuracy in measuring the quantity of oil delivered through each connection.

Thirteen Type A, Model 1 pumps have been equipped with distribution blocks. They now supply oil to 44 lubrication points. Previously 44 individual pumps were used.

Tests showed that the initial units were far off balance. Satisfactory blocks were developed in cooperation with the manufacturer. Blocks now are accepted only within a ± 5% variation. Blocks have been found with only ½ to 2% variance.

Use of distributor blocks makes it possible to combine all points of feed to a cylinder into one block and one lubricator pump. This doubles, triples, or quadruples the rate of delivery from the lubricator pump, thereby improving its efficiency and providing assurance of continued delivery.

O-ring installation. Despite discouragement from manufacturers, we have a number of O-ring-equipped pumps in operation.

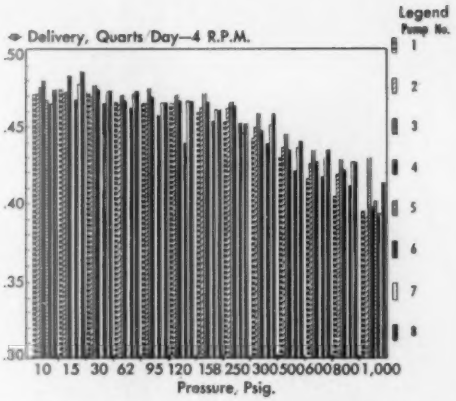
Twelve discarded pumps were equipped with O-rings. They were tested at 0.100-in. stroke at 500 lb. and 1,000 lb. with a rerun at 500 lbs. The per cent variation from maximum to minimum delivery was 19.9%, 12.4% and 8.5%. The average measured delivery in each case was above the delivery expected at these pressures.

Three pumps were taken out of service and sent to the laboratory for testing. On two runs at 1,000 lb. pressure and 0.150-in. stroke, the average delivery was 0.926 qt. per 24 hours as compared with 0.930 qt. per 24 hours, according to the delivery charts. On two runs at atmospheric pressure and 0.150-in. stroke, the average delivery was 1.05 qt. per 24 hours as compared to 1.06 qt. per 24 hours, according to the delivery charts.

Differential pump. Six Type A Model 4 differential lubricator pumps were tested at 975 lb. and 0.100-in. stroke. Four stopped delivering oil within 15 minutes. The test was continued for 3½ hours and the two operating pumps showed a delivery of 19 and 33% of the theoretical expectancy.

In the belief that this pump would bypass oil back into the reservoir, the drain hole from the chamber at the upper end of the pump plunger was plugged and a small line was installed from this chamber into a measuring container.

Three pump plungers were



DELIVERY RATE varies with pressure and from pump to pump. Fig. 1.

equipped with O-rings and tested against six other pumps, including four new ones, without O-rings. The three O-ring-equipped pumps had slippage of 0.9 gr. as compared with 256.4 gr. for the four new pumps without O-rings. In total delivery, only 5% variance occurred at 985 lb. on the O-ring-equipped pumps as compared to 119% on the others.

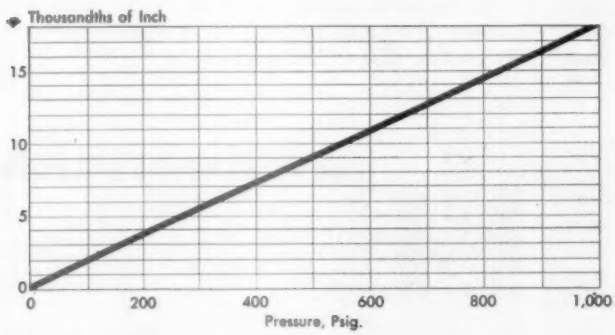
In a field test, an O-ring pump averaged slippage of 1.5 gr. for 62 days when the O-ring gave way and slippage increased to an average of 8 gr. per day for an additional 30-day run. It was replaced with a second O-ring pump which operated continuously for 7½ months averaging slippage of 3.5 cc. per day.

A complete engine was equipped with O-ring differential pumps. The units supplying oil have been in operation more than a year with satisfactory results. The units supplying oil against the compressor cylinder pressures failed within a 3-month period. Grooves have been machined in the pump body for O-rings and smooth pump plungers are used. This installation has been in service for 10 months with satisfactory results.

Oil-level regulators and flowmeters. Another test involves two Type A oil-level regulators and two Type A flowmeters. A force-feed lubricator hookup and a simulated crankcase installation has been tested for both level control and accuracy of the flowmeter.

Liquid level was very accurately maintained and the meter on the lubricator checked to within 0.11% of the weighted volume pumped from the reservoir. The unit on the crankcase setup checked to within 1.3%. Pressure head of 3 lb. and 7 lb. was maintained on the input side of the flowmeters.

Personnel. Frequently the least-able man is made oiler, often with the responsibility for lubrication of



STROKE CORRECTION CHART for pressure operation of Type A, Model 1 lubricators. Fig. 2.

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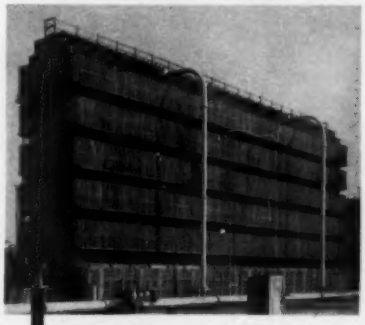

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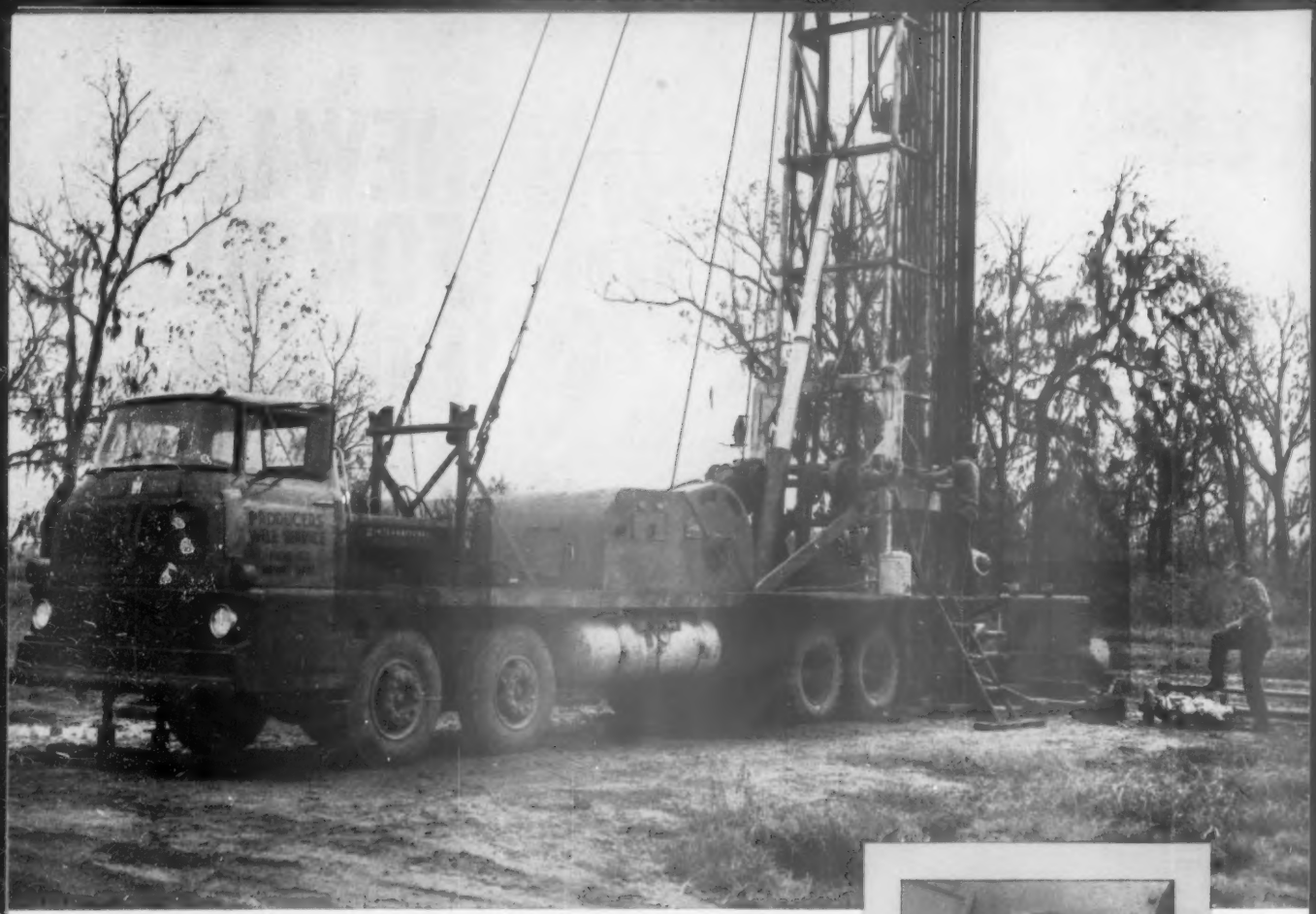

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The rig above is one of three owned by Mr. Pumphrey, and is powered by an International UV-549 V-8 engine. The self-propelled Sky-Top Traveller has a 66-ft. derrick for working double lengths, and services wells up to 11,000 feet. Another engine, an International U-450, drives a Gardner-Denver 5 x 10 pump supplying salt water to kill bottom hole pressure.

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the operating equipment. Frequently too, he is the first person promoted so that change of personnel is constant.

Oilers of this caliber know only to fill the reservoir and maintain delivery from the pumps, with no idea as to which pump serves a specific point. Lubrication thus is looked on as a menial task. Actually it should be placed under the supervision of a competent man who can see what is going on in an engine and who knows whether or not each point is getting proper lubrication.

Outlook. The future may hold much in the way of pump modification. Engine manufacturers may learn how many lubrication points there should be and where they should be. Spot control may come for it is reasonable to assume that the thrust, or hot side, of a piston may require more oil. Pending developments may bring about the horsepower-hour per gallon of oil that we are looking for.

Canadian gas fields opened

THE Northern Foothills Agreement group, one of western Canada's biggest oil-natural gas producing groups, has agreed to sell gas to Westcoast Transmission Co. after holding out for 7 years.

The group, composed of British-American, Shell, Texaco and Mobil Oil, will ship gas through the Westcoast pipeline from two northeastern British Columbia fields.

A Westcoast spokesman said the group will receive 10¼ cents per M.c.f. for its gas, one cent more than other producers in the province. But its percentage from revenues of gas byproducts recovered from the scrubbing plant at Taylor, B. C., near Dawson Creek, will be smaller than the percentages of the other producers.

It is reported that the group had been holding out for about 12 cents per M.c.f. Neither side would comment on past negotiations.

The NFAG had completed a number of wells at Buick Creek and Nig Creek in the north and all had been capped. The group will provide 15,000 M.c.f. of gas daily at the start from these fields. Eventually supply is expected to rise to 60,000 M.c.f.

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Why not get more familiar with how these Darling valves perform and what they offer you in avoiding trouble and downtime? Simply ask for Catalog No. 57.

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Sandilands Valve Manufacturing Co., Ltd., Galt 19, Ont.

▶▶▶ New Equipment Section

This week's SHOWCASE features . . .

Two front-axle duals

. . . featuring independent front-wheel rotation are now available as optional equipment on the Cardwell Models KM 250 and 210 drive-in rigs for use in drilling, servicing, workover, and well completion.

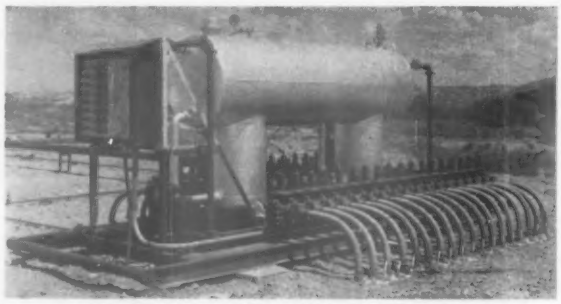
An advantage of the independent wheel-rotation feature is that it allows each wheel to turn at a different speed. This is claimed to eliminate drag and tire wear while maintaining the maneuverability of single-wheel axles.

According to the maker, the axel load remains unchanged, but the load is distributed to more tire and ground surface. Consequently, it lowers the unit pressure and permits a heavier legal rig load, minimizes surface damage on lease roads and lightly constructed access highways, and prevents "sinking-in" on soft terrain and in the area close to a well. A system is provided for equal braking on all wheels. Source: **Cardwell Mfg. Co., P. O. Box 2001, Wichita, Kans., U.S.A.**

Packaged well-test unit

. . . is available that automatically diverts the fluid streams from wells, then separates, measures, and records the production. The unit uses pneumatically operated valves.

Through a weatherproof control panel, the unit automatically programs any number of wells, in sequence, for scheduled test. After separating the oil, gas, and water, it measures the oil and water in a liquid meter in the legs of the monotube separator and records the accumulated volume of each product on reset counters.



A strip-chart recorder indicates if a well is flowing and/or surging. The chart also indicates the best production hours, proper operation of a pumping well, and the well performance. After a test, the separated products are commingled and returned to the production line. If power fails, all valves are diverted to production and any or all wells may be shut in manually. Source: **National Tank Co., Drawer 1710, Tulsa, Okla., U.S.A.**

■

Two new tubing heads

. . . recently announced, are full opening in all sizes and come in sizes from 2 through 7 in. o.d. The maker says they have three-segment hinged slips which will safely suspend up to 5,000 ft. of ¾ through 2½-in. EUE tubing or up to 3,000 ft. of 3-in. regular through 4-in. EUE tubing.

The Type H head, with a male connection only, is rated at 500 psi.

Want more facts about equipment or copies of product literature described in this issue?

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to manufacturer at address shown in bold type after each item.

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New Equipment

w.p. The Type Q, with female connection only, is rated at 750 psi. w.p.

All cast parts are ductile-iron. All steel parts are made of J-55 casing or of forgings with equivalent properties, the maker says. A Hycar packing ring is used. All threads are current API threads. Source: **Larkin Packer Co., Inc., Waxahachie, Tex., U.S.A.**

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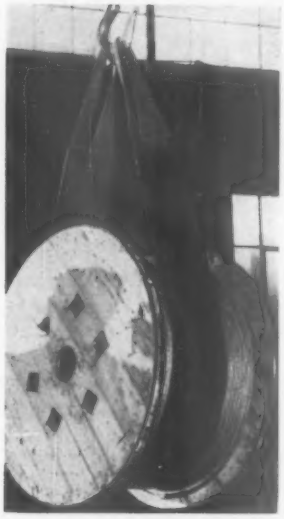


Lightweight belt slings

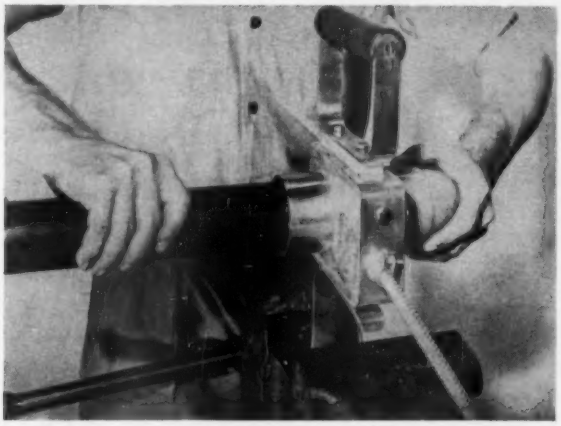
. . . made of nylon and dacron have been developed. The Safety-Weave web slings come in a variety of widths, lengths, and capacities. Optional for the slings is a neoprene coating which, according to the maker, increases the slings' abrasion resistance by 50% and the coefficient of friction to a minimum of 2½ times that of other impregnating material.

The maker claims that 80% of the slings' reserve strength is concentrated in the inner piles. These are protected from abrasion by two tough outer piles. The slings are said to be unaffected by mildew, rot, bacteria, or water, to have excellent handling properties at low temperature, and to provide safe duty up to 8 to 10% elongation. Source: **Jones & Laughlin Steel Corp., 3 Gateway Center, Pittsburgh 30, Pa., U.S.A.**

Device protects equipment

. . . from damage due to excessive vibration. It is a resonance type of vibration monitor that flashes a signal or stops a machine if vibration amplitude exceeds safe limits.

With an accessory plug-in attachment, the monitor can be used as a portable balancer in correcting the condition causing the vibration. Among the equipment which can be protected against excessive vibration are gas turbines, pumps, electric motors, fans, and blowers. Source: **Stewart-Warner Corp., 1826 Diversey Parkway, Chicago 14, Ill., U.S.A.**



Thermoplastic pipe joined fast

. . . with a new and portable tool. The Thermo-Seal heating tool is claimed to overcome difficulties in joining industrial pipe made of chlorinated polyether, polyproplyene, and polyethylene by solvent cementing or threading.

The bonding method involves the homogeneous intersurface thermal fusing of pipe and socket type of fittings. The maker claims the device makes a leakproof bond in a few seconds and that the pipe is then ready for pressurizing.

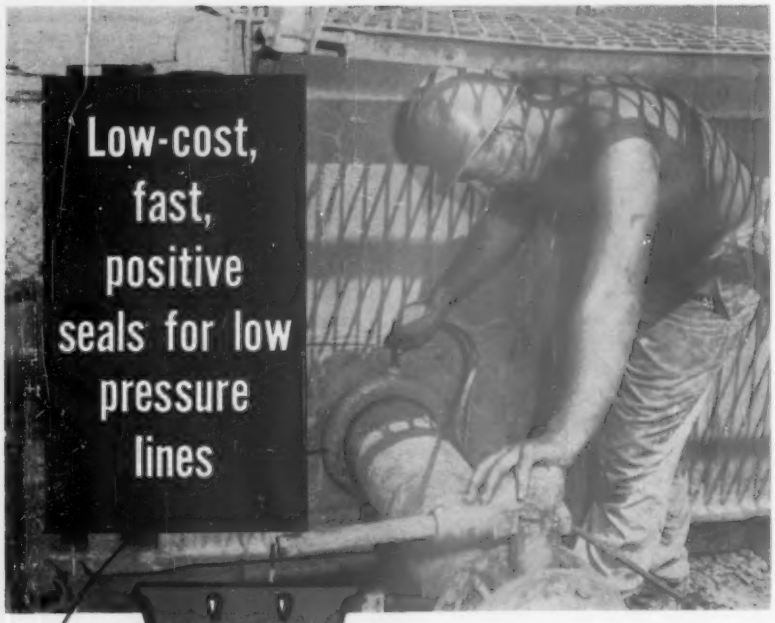
The tool is an aluminum assembly. Components include a cast-in tubular electric heater and two surfaces upon which the pipe ends and the fittings sockets are heated at the same time to fusing temperature. After the pipe and fitting socket are heated, they are removed from the tool and joined.

The joining tool comes in two models. It handles pipe sizes from 2½ to 6 in. Weighing under 10 lb., it operates on 110 volt a.c. power. Source: **Tube Turns Plastics Inc., 2929 Magazine, Louisville 11, Ky., U.S.A.**

●

Drill-bit deflectors

. . . have been developed for the Blue Demon four-blade insert bit, the maker announces. The bit is designed for seismic shot-hole drilling. The deflectors are designed to deflect the drilled cuttings away from the center of the bit and into the return circulation stream. The deflectors are forged into the face of the blade. They are said to be equally effective with either water or air as the circulation medium. The deflectors tend to prevent plugging, which will



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make the bit particularly effective in drilling alternating layers of hard and soft formation.

The deflector-equipped bits are available in all popular shot-hole sizes. Source: **Herb J. Hawthorne, Inc., P. O. Box 7366, Houston, Tex., U.S.A.**

●

Portable, powered valve operator

. . . the Pow-R-Drive is designed to make valve opening and closing easy. The device weighs only 38 lb. and is easily picked up and handled by one man, the maker says.

The unit is said to be ruggedly built to withstand tough field jobs and can be used in numerous places.

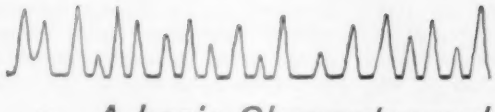
Either a quick-reverse air or electric motor can power the operator. It rotates at 20 r.p.m. in either direction. A safety control shuts off power if the unit slips away from the operator's hands. Source: **E. H. Wachs Co., 1525 N. Dayton, Chicago 22, Ill., U.S.A.**

●

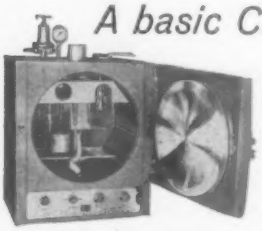
New plant for water-flood use

. . . introduced recently, a pilot-plant clarifier-filter package, is constructed for use in gathering data essential for the design of a water-treatment plant for water-flood operations.

Skid-mounted and portable, the unit consists of nine parts: clarifier, surge tank, optional anthracite or diatomite filters or both, flowmeter, and five chemical feeders for coagulants, coagulant aids, filter floc, corrosion inhibitors, or biocides as treatment may demand. The unit is available on a monthly rental basis. Source: **Hagan Chemicals & Controls, Inc., Oilfield Div., Hagan Center, Pittsburgh 30, Pa., U.S.A.**



A basic Chromatograph



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SHOWCASE . . .

New Literature

New jet-flame burner

. . . for butane, propane, and other liquefied-petroleum gases is outlined in a new literature piece just made obtainable. The Model CW-2 burner reportedly is capable of producing 2,300° F. heat faster and cleaner than other models. According to the bulletin, the Model CW-3 burner, weighing only 5 lb., 10 oz., has a capacity of a million B.t.u. on 20-lb. pressure. The burners are designed for use in heating, thawing, and burning. Source: **Corwill International Corp., Box 1030, Cedar Rapids, Iowa, U.S.A.**

Proper truck selection

. . . is discussed in a new eight-page brochure, the fifth in a series of technical reports designed to give materials-handling engineers data to be used as ready reference to everyday handling problems. Case histories show how the wrong truck installed can cause unproductive output and increased costs. Correct solution, plus five pages of application photos show the importance of truck selection. Also listed are seven tips for choosing the right truck to fit different applications. Source: **Automatic Transportation Co., 149 W. 87th, Chicago, Ill., U.S.A.**

Electrical products

. . . including electrical connectors, receptacles, switches, and lighting products, are featured in a four-page publication just released. Included in Bulletin B81 are illustrations, specifications, and suggested applications for conventional and custom-built electrical connectors. Also featured are general descriptions of lighting products, information on push-button switches, and cable vulcanizers. Source: **Electrical Products Div., Joy Mfg. Co., 1201 Macklind Ave., St. Louis 10, Mo., U.S.A.**

Chemical cleaning

. . . with citric-acid solutions is covered in Data Sheet 557, yours upon request, which contains sections on acid cleaning with ferric and ferrous-ion solutions, advantages of ammoniated citric in chemical cleaning, along with an introduction, summary, and appendix. Source: **Chas. Pfizer & Co., Inc., 630 Flushing Ave., Brooklyn 6, N. Y., U.S.A.**

New malfunction detector

. . . called "Vibraswitch" is detailed in new special application Report V-103 now available. It outlines six specific instances in which the instrument protected various pieces of equipment and prevented extended down time or serious damage. Examples cited include motor-bearing malfunction, pump ball-bearing failure, chipped drive-gear tooth on a high-power tower-cooling fan, and timing of suction and other pumps in transfer tanks. Source: **Aeronautical & Instrument Div., Robertshaw-Fulton Controls Co., Santa Ana Freeway at Euclid Ave., Anaheim, Calif., U.S.A.**

New core-drill apparatus

. . . designed for rugged field service, deep core drilling, and versatile operation, is described in new six-page Bulletin 31. The Presidente drill, designed for use in soil sampling, rock coring, and construction operations, is said to core to depths of 4,500 ft. The bulletin describes the rig's special features and related accessories. Source: **Soiltest, Inc., 4711 W. North Ave., Chicago 39, Ill., U.S.A.**

Wrought-iron welding reducers

. . . concentric and eccentric in sizes from 1 through 24 in., are priced in a new single-page illustrated sheet now available. Prices are given for various pipe sizes in both the maker's standard and extrastrong materials. Source: **Steel Forgings, Inc., Box 276, Shreveport, La., U.S.A.**

Valve-lubricant gun

. . . which is lightweight, portable, and air-operated, is described in a new six-page bulletin recently issued. Designed especially to meet field and plant maintenance valve uses, the mobile, 53-lb. Hypregun is intended for use in refineries, compressor stations, gasoline plants, cycling plants, pipelines, and christmas-tree installations. Source: **Meter & Valve Div., Rockwell Mfg. Co., 400 N. Lexington Ave., Pittsburgh 8, Pa., U.S.A.**

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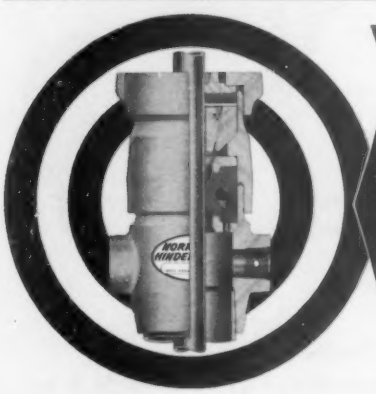

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WRITE FOR NEW WELL HEAD BULLETIN P. O. BOX 1739, TULSA

TUBING CASING HEADS

▶ ▶ ▶ Equipment Men Notes

Foxboro adds marketing division

C. Schwarzler

. . . to serve its associated companies in England, Canada, Holland, and Japan, as well as its United States market, according to R. A. Bristol, executive vice president and director of sales.

Appointed vice president of marketing is Charles Schwarzler who, as head of the new division, will be responsible for planning and directing

H. O. Ehrisman

V. V. Tivy

the development of new market areas and disseminating Foxboro instrument engineering information throughout the world. He will also direct the company's sales promotion and publication activities.

H. O. Ehrisman has become vice president and U. S. general sales manager. His primary responsibility will be the company's 61 branch offices in major industrial cities of the United States and related home-office sales operations.

V. V. Tivy, in his new position of director of engineering, will be responsible for the interpretation of market trends in instrumentation and for encouraging the development and initial sale of new products to meet these trends. He will also continue as head of the company's Systems Engineering Division.

4 new board members elected

. . . by the Petroleum Equipment Suppliers Association. In addition, a new Pacific district chairman has been designated.

New directors from the Gulf Coast district are: Paul F. Carmouche, Murray-Brooks, Inc., Lake Charles; J. T. Kenneally, Houston Oil Field Material Co., Inc., Houston; and W. E. Scarborough, Reed Roller Bit Co., Houston. New director from the Pacific district is Elmer J. Weis, Pacific Pumps, Inc., Huntington Park, Calif.

The new Pacific district chairman is H. H. Peters, Technical Oil Tool Co., Los Angeles. A member of PESA's executive committee, Peters replaces W. A. Wilson, who resigned as director and chairman of the Pacific district.

Tretolite Co. makes additions

. . . to its sales and service staff, announces J. E. Stockton, Jr., sales manager of the division of Petrolite Corp.

Claude H. Collier, formerly with American Oil Co., Yorktown, Va., has joined the company as refinery chemical engineer at Bound Brook, N. J. Charles W. Fetrow, former supervisor for Gulf Oil Corp., Philadelphia refinery, becomes Tretolite's refinery representative at Springfield, Pa.

Other additions to the sales department include: D. L. Childress, former pilot for Rogers Geophysical Co., assigned to pilot Tretolite's new float plane servicing the South Louisiana district. He is located at Houma, La.; James A. Gregory, formerly with Mobil Oil Co., at Andrews, Tex., field engineer trainee in the west-central division; and Carl R. Oglesby, who was with Calvert Petroleum Co. before becoming field service engineer for Tretolite, now locating at Mount Vernon, Ill.

Burgess-Manning Co. promotes

. . . two sales executives within its Industrial Silencer Division: William A. Carroll, Jr., goes from sales manager to manager of marketing, and R. T. Oliver, Jr., former New York district sales manager, becomes sales manager for domestic operations. Carroll will

W. A. Carroll, Jr.

R. T. Oliver, Jr.

coordinate over-all sales activities, including a newly established international operation.

Carroll began with the company's engineering department and later transferred to the sales department. He, too, was formerly district sales manager in New York, and now resides in Dallas. Oliver, who has been with the company 9 years, has moved to Dallas to the company's general offices. He has held positions as sales correspondent and sales engineer in the Dallas, Chicago, and New York offices.

Paul Bartley named sales v.p.

. . . of Black, Sivalls & Bryson, Inc., in a consolidation of the sales organizations of BS&B's Oilfield Equipment & Controls Divisions. Bartley, with more than 20 years of sales-management experience with BS&B, most recently was manager of the Oilfield Equipment Division. He continues to locate in Oklahoma City.

Paul Bartley

For marketing purposes, the United States has been divided into eight regional territories. Seven regional-manager appointments have been announced: Floyd C. Myers, a vice president, Gulf Coast region, Houston; Lee Kelton, southwest region, Dallas; Ralph Stevens, Mid-Continent region, Oklahoma City; L. E. Jones, Rocky Mountain region, Casper; Austin Lyon, north-east region, New York City; James Lee, north-central region, Carmi, Ill.; and William E. Lacy, western region, Los Angeles.

At the central sales level, executive staff appointments include: James E. Byers, manager of product sales, oilfield equipment; and Edward W. Reif, manager of product sales, controls and specialty products.

Swiss subsidiary is established

. . . by Caterpillar Tractor Co. to take over selling and servicing of company products primarily outside the Western Hemisphere. In Australia and the United Kingdom, however, regular Caterpillar companies will continue to handle such matters.

Headquarters of the subsidiary—Caterpillar Overseas S.A.—will be in Geneva, Switzerland. Management and certain technical and specialized personnel will move there during the next few months to head the operations. V. V. Grant will be president; R. H. Deffenbaugh will be secretary-treasurer; J. R. Hawk, sales manager; and G. J. Preston, parts and service manager.

Pfaudler Permutit forms pact

. . . with Krupp-Dolberg, of Essen, Germany, whereby the corporation's Pfaudler Division in Rochester, N. Y., will market the Krupp-Dolberg line of centrifuges.

According to terms of the agreement, Pfaudler now has exclusive rights for marketing the Krupp line of basket centrifuges in the United

NEW FROM OTIS

TYPE BC WIRE LINE BRIDGE PLUG

- Short, compact—less to drill up.
- Small O. D. for easy running.
- Covers wider range of casing weights.
- Can be set with any pressure setting tool.

Here's a casing bridge plug with more plus features than any other plug on the market—yet it costs you no more! It's short and compact—less to drill up—designed to save you up to 50 per cent in rig time when the plug is removed. The Type BC Otis Wire Line Bridge Plug is designed to provide a positive plug, to prevent movement of fluid or gas from either direction in the casing, or to plug and abandon. The Type BC has a small O.D. for ease of running—yet it is designed to set in a wider range of casing weights than any other plug available today.

AVAILABLE THROUGH ANY ELECTRIC LINE SERVICE COMPANY. The Type BC Otis Wire Line Bridge Plug is available through any electric line service company and may be set with any pressure setting tool. Otis bridge plugs are stocked at more than 247 different field locations to make sure they are readily available to the service company of your choice. The next time you need a bridge plug—specify Otis.

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OTIS ENGINEERING CORPORATION
General Offices: 6612 Denton Drive, Dallas
Branches Throughout the Oil Country

States and Canada, and when sales volume reaches a predetermined amount per year, after 1963 Pfaudler will be licensed to manufacture, at its option, in accordance with Krupp designs.

Halliburton Co. makes changes

D. R. Yager

. . . following the retirement of D. R. Yager, central region vice president, who had been with the Duncan, Okla. firm for nearly 35 years. E. L. Paramore, southern region vice president, will take charge of the firm's central region, and Travis Phillips, Shreveport division manager, will assume duties as southern regional manager.

Other moves announced by Harry P. Conroy, Halliburton's vice president in charge of field operations, include: C. L. Fulton, assistant division manager at Midland, shifted to Shreveport as division manager; F. C. Moody, assistant division manager at Denver, transferred to Midland in the same capacity; and C. L. Bramlet, assistant division manager at Corpus Christi, replacing Moody as assistant division manager at Denver.

E. L. Paramore

Travis Phillips

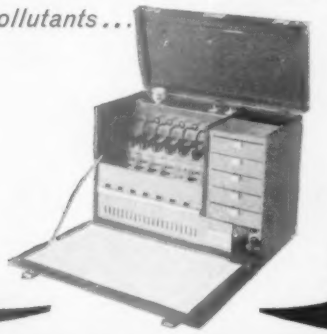
Robert Evans is engineering v.p.

. . . of Smith Tool Co., a division of Smith Industries International, Inc. After joining the company in 1954 as chief metallurgist, Evans was promoted to director of research and development 4 years later, the position he held until the present.

J. L. Huss becomes manager

. . . of customer distribution service, a new department established by Crane Co. Industrial Products Group to render customer order service and control of inventory at stock service centers. Huss has been with Crane Co.'s Toledo office since 1950. In Toledo

For quick, simultaneous analysis of 18 pollutants...



NEW AIR POLLUTION DETECTION UNIT

Gives fast, reliable, on-the-spot analysis simultaneously of 18 major pollutants in the atmosphere. A lightweight, "portable laboratory" that plugs into the 12 volt car lighter receptacle. (Units for other voltages on special order.) Contains all the equipment needed for routine tests. Write for Booklet 313. No. 20770 $595.00

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NEW! EDITORIAL FILE CASE

This file case, made especially for The Oil and Gas Journal from heavy Binder's Board, measures 11¼" x 12" x 3", and contains six heavy-duty folders. Perfect for filing tear-sheets or safekeeping of Journal handbooks.

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OIL WELL PUMPS

Sand Protected

SUB-SURFACE ROD PUMPS

Self-Aligning

SAND SEALED-OFF ROD PUMPS

Figs. 600, 800, 900

Inverted combination single or double plunger self-aligning pumps, equipped with sand flush valve

- Cleans barrel every stroke
- Sand deposited in blind cage, discharged every stroke
- Plunger bottom sealed to prevent slippage
- Fits any API seating device; use adapter for other types
- Full working stroke assured

Fig. 201A

COMBINATION

ROD GUIDE and PARAFFIN SCRAPER

Exclusive Thompson device, standard with many operators!

- Reduces rod & pump wear
- Insures proper alignment
- Removes paraffin ahead of pump
- Allows pump to pull freely

SERVICE STORES for your convenience! Stores have service men as well as salesmen to serve you . . . prompt pick-up and delivery!

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Jimmie Gray®
500 TON
. . . now with
POLARIZED
ADDITIVE!

Greater "Clinging" Power for Increased Thread Protection!

Used on more wells throughout world-wide drilling industry!

SOLD ONLY THROUGH SUPPLY STORES

MONEY BACK GUARANTEE

USE JIMMY GRAY DOPE BRUSHES

PETROLEUM DISTRIBUTING CO.
BOX 203—HOUSTON, TEXAS—CApitol 4-9648

his assignments varied from warehousing to field work as a sales representative. In 1954 he was transferred to Cincinnati where he became manager of the stock-order department, later becoming assistant manager.

Jack R. Russell named director

J. R. Russell

. . . of sales and service for domestic and foreign operations of Lynes, Inc., according to George Canfield, vice president and general manager of the Houston manufacturer of inflatable oil-well packers. Prior to joining Lynes, Russell was northern region manager of Otis Engineering Corp., Dallas. He had been with Otis 9 years, working in the Mid-Continent area, starting as a field sales-service man.

Inspection company in Germany

. . . called Universal Engineering Co., Rohrenprufungen und Handelsgesellschaft, mbH, with headquarters in Dusseldorf, has been formed by Atlas Bradford Co.

Personnel includes Hellmut Reichenbacher, of West Germany, who will maintain contact with in-

H. Reichenbacher

L. M. Johnson

dustries in need of tubular-goods-inspection service, while shop and field activity will be under the supervision of L. M. Johnson, who has been with Universal Inspection & Service Co., Houston, Tex.

Facilities have been installed in Dusseldorf for complete nondestructive inspection and testing of tubular goods, with equipment available for mill and field inspection of tubular goods. In addition to West Germany, field service will be available in France, Belgium, Italy, and the British Isles.

A. G. Evans-Lombe becomes

. . . a special representative for Iverson Supply Co., Tulsa. Formerly vice president and general manager of Parkersburg Rig & Reel Co. in Fort Worth, Evans-Lombe has had more than 35 years' experience in oil-field supply.

here's how Depban works to stop paraffin troubles before they start

This photograph shows how Depban* paraffin inhibitor works.

Both steel cylinders were given a coating of paraffin similar to that which occurs under actual well conditions.

There was one difference, however. The cylinder on the right had been treated previously with Depban.

This photograph was taken just 25 seconds after both cylinders were immersed in tap water at room temperature. Notice that paraffin on the cylinder treated with Depban is falling off rapidly while paraffin on the untreated cylinder is unaffected.

For full details on this revolutionary new way to control paraffin problems, call your Dowell representative. *DOWELL TRADEMARK

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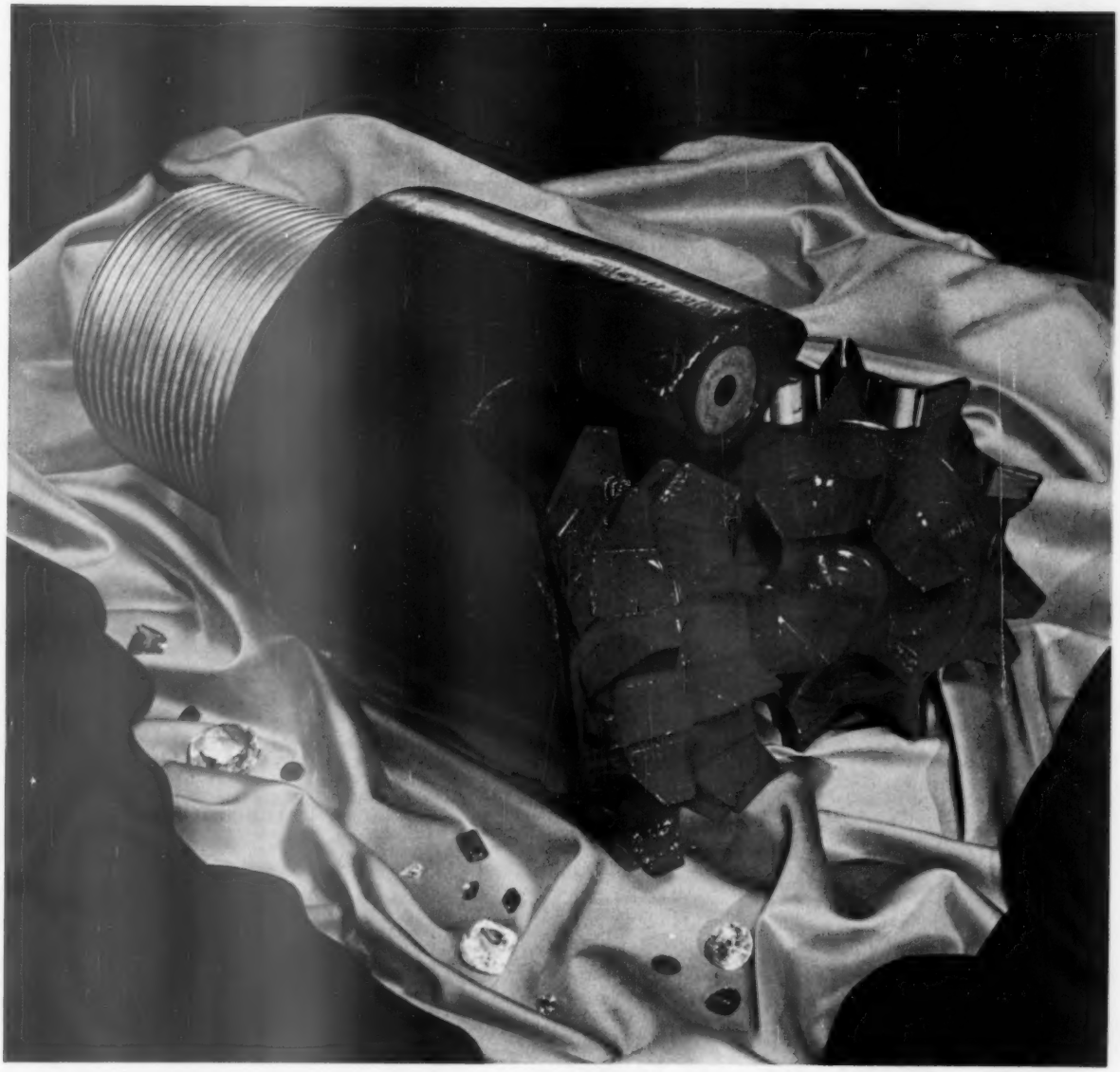
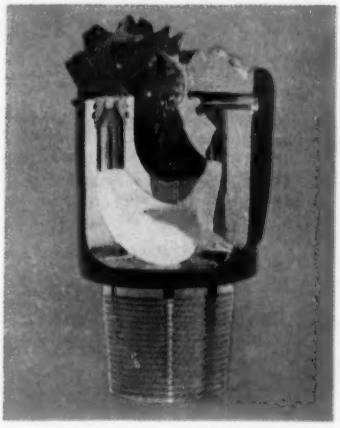


A SECURITY FIRST! New Extended Jet 2-Cutter Bit

Nothing drills like the new Security Extended Jet . . . because *there's not another bit like it!* This Security-First in 2-cutter bit design is setting new standards of superior performance. In formations of high drillability where added cleaning of bottom hole is vital, the new 2½" closer-to-bottom jet gives extra penetration speed. Less downtime and more accuracy are assured for straight hole and specialized directional drilling!

Call or write today for complete information and size availabilities on this revolutionary Security FIRST!



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ONE OF THE DRESSER INDUSTRIES

ANOTHER HOMCO
DIRECTIONAL DRILLING
SUCCESS REPORT

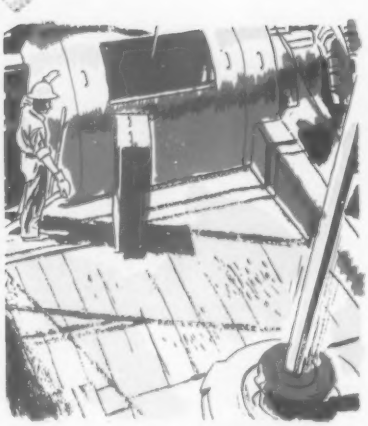
Two Directional Drilling problems where Homco equipment saved hours of rig time

Gulf Coast independent operator says:

"Homco's Mechanical Orienting Tool saved me eight hours and fifteen minutes wire line time on two settings below 14,000 feet."

Terrebonne Parish, Louisiana

1- First whipstock was set at 14,363 feet with conventional BHO method and checked. Time required to orient tool was four and one-half hours. Second whipstock was set at 14,821 feet using a 6" O.D. Homco Mechanical Orienting Tool. Time required was thirty minutes. (Results were perfect.)



2- Third whipstock was set at 15,080 feet with the same Homco Mechanical Orienting Tool. Time required fifteen minutes. (Perfect results.)

3- The Homco Mechanical Orienting Tool saved more than four hours rig time each time it was used. It also eliminated the hazard of stuck pipe as the string can be actuated and circulation maintained. Abnormally high temperatures and extremely heavy muds have no effect on this tool.

Homco Mechanical Orienting Tool*

The HOMCO Mechanical Orienting Tool presents a new concept for orienting whipstocks and deflecting tools without the use of subsurface surveying instruments, which previously required two or more trips with a wire line to correctly orient the deflecting tool. The drill pipe is raised, rotated, and lowered until a ball falls into a slot which permits the tool to close and indicates that the deflecting tool is correctly oriented.

ADVANTAGES: Eliminates numerous trips into the hole with subsurface surveying instruments. Reduces orienting time to approximately twenty (20) minutes. Torque in drill string does not affect setting. Not affected by high temperature. Write for Technical Bulletin #51-1-1.

*Patent—U.S. Letters Patent No. 2,686,660

NEED THE ANSWER

TO A DIRECTIONAL DRILLING PROBLEM?

HOMCO HAS IT!

HOMCO

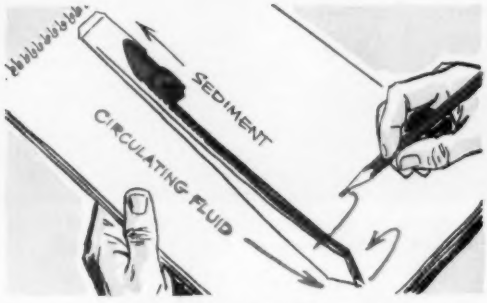
DIRECTIONAL DRILLING

California tool pusher says:

"Homco's Circulating and Releasing Whipstock is the only tool that circulates to the bottom of the hole and assures a firm setting for the whipstock."

"We've learned now that when we have to set a deflecting tool in the hardrock country, it saves time and money to have the Homco Circulating and Releasing Whipstock on hand. It has saved us rig time in West Texas, California, the Rockies, and Canada."

1. The HOMCO C&R Whipstock is installed on the drilling string and is lowered into the hole. There is no danger of shearing the pins. Should a bridge or fill be encountered, the whipstock is raised, circulation started, and the tool is rotated through the obstruction.



2. On reaching the bottom of the hole, circulation is commenced to wash any sediment or cuttings free which may impede the setting of the whipstock. Circulation and rotation are continued until the whipstock can be set firmly on the bottom of the hole. The whipstock can now be oriented in the correct direction by means of the HOMCO Mechanical Orienting Tool, or by other sub-surface orienting means.

3. After orientation, a ball is dropped into the drill pipe and pumped down to land in the ball seat on the upper end of the piston in the setting tool. The pumps apply pressure to the piston assembly until the pins between the upper shell and piston are sheared. The piston is forced downward permitting the shear balls to be forced from a position between the whipstock collar and lower shell into the setting tool. This diverts the circulation from the whipstock to the drill bit and disengages the setting tool from the clutch arrangement in the whipstock collar by lowering the drill string slightly. When disengagement is accomplished, rotation is commenced and a rathole is drilled in the conventional manner.

Homco Circulating and Releasing Whipstock*

In most directional drilling operations, a problem is the removal of sediment and cuttings that settle to the bottom of the hole after circulation ceases. This fill prevents the whipstock from reaching the bottom of the hole.

The HOMCO Circulating and Releasing Whipstock permits sediment to be circulated out of the hole before setting, eliminating mis-runs with whipstocks. The circulating fluid is channeled through the whipstock to the lowest point of the tool. While circulating, the HOMCO C&R Whipstock can be rotated without danger of shearing pins, assuring a firm seat.

ADVANTAGES: Eliminates danger of shearing pins while going into the hole. Whipstock can be rotated without danger of shearing pins. Circulation can be obtained at bottom of the tool where it is needed. Whipstock can be rotated and circulation maintained on bottom before setting, to assure a firm seat. Write for Technical Bulletin #94-7-1.

*Patent—U.S. Letters Patent No. 2,823,012

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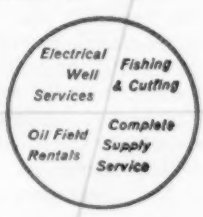
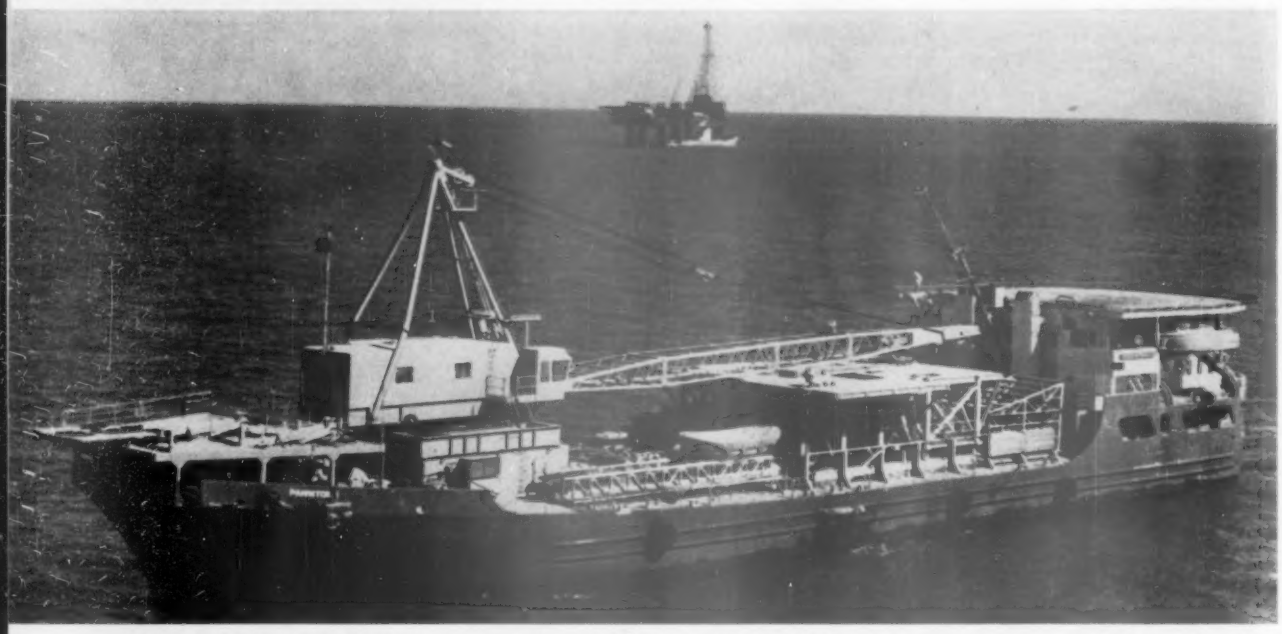




DRILLING VESSEL "PANINTOIL" is an unusually self-sufficient craft. The 60-ton Clyde crane allows assembling and teardown of the drilling derrick without a derrick barge.

Engines convert for cruising and drilling

A SELF-POWERED drilling vessel has recently completed a trip halfway around the world using the engines it will drill with when it arrives on location in Iran offshore waters.

The drilling tender was powered by two General Electric diesel-electric motors and completed the voyage in half the normal time it would take if it had been towed from Texas to the Persian Gulf.

The 9-knot "Panintoil No. 1" vessel took slightly less than 2 months to travel the 10,500 miles from the Gulf of Mexico, across the Atlantic Ocean, Mediterranean Sea, and Red Sea to the Indian Ocean and finally to the Persian Gulf. The trip halved the normal time which would have been required to tow a drilling barge the same distance.

Unique in marine engineering, the Panintoil uses a dual-purpose diesel-electric power plant. It drives the vessel's propulsion shafts when the ship is under way, and when on location the generators are switched electrically to provide power for the drilling operations.

The power system, developed by General Electric's locomotive and car-equipment department, eliminates the need for additional power sources, providing a substantial saving in engine-room space. Believed to be the most modern drilling tender in operation, it is supplied by three service vessels and two helicopters based at Khosrowabad.

The Panintoil, now equipped with a 20,000-ft.-capacity drilling rig, is drilling an exploratory well in a 6,177-sq.-mile agreement area in the northwestern portion of the Persian Gulf. Originally intended for coastal operations, the ship is working in 142 ft. of water, 22 miles from the nearest shore.

The craft was built by New York Shipbuilding Corp., of Camden, N. J., and equipped for drilling by Ideco, Division of Dresser Industries, Inc., of Dallas.

It is equipped with five Caterpillar D397 turbocharged diesel engines rated 500 hp. at 1,200 r.p.m. directly connected to General Electric GE752J differential-compound drilling generators.

Varying combinations of the basic power source drive seven GE 752H drilling motors during normal operations. The system is controlled from a driller's console located on the platform.

The draw works, an Ideco E-2500, one of the largest draw works built, is driven by two of these motors. The Ideco catworks and 27½-in. rotary table are powered by a third drilling motor. Two 1,000-hp. mud pumps are each driven by two drilling motors.

The all-welded steel tender hull is 272-ft. long with a beam of 56 ft. and a loaded draft of 17 ft. There is a 56 by 60-ft. helicopter deck aft. The living quarters for 58 operating personnel located aft include a recreation room, lounges, offices, messrooms, and galley. All living quarters are completely air-conditioned to provide relief from the 130° heat.

A complete machine shop and electrical work shop are contained in the vessel. It has storage facilities for 5,000 sacks of bulk mud, 1,800 bbl. of liquid mud, 2,500 sacks of bulk cement, 12,500 bbl. of drilling water, and 500 bbl. of drinking water.

Smith TYPE DT ROCK BITS

FOR SOFT FORMATIONS

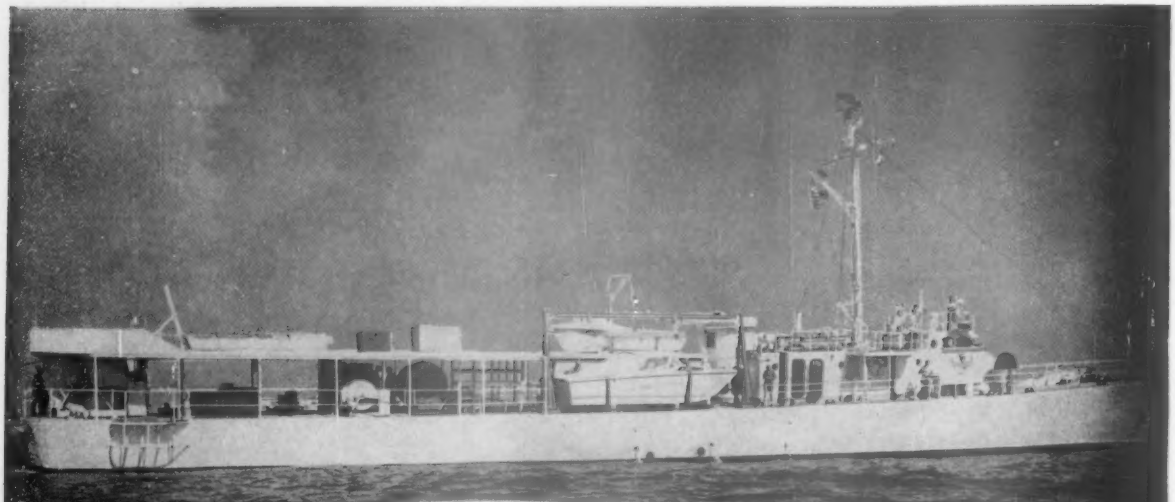
The SMITH TYPE DT 3-cutter rock bit is designed and constructed to insure rapid rates of penetration in moderately soft to soft formations...sturdy, deeply cut and widely-spaced teeth...optimum self-cleaning properties are provided by the widely-spaced teeth in combination with ample tooth deletions and efficient flushing action of the circulating fluid.

Smith TOOL CO.

A Division of SMITH INDUSTRIES International Inc.

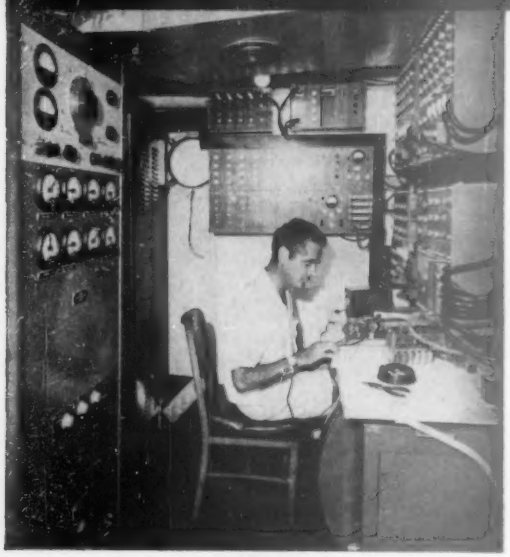
COMPTON, CALIFORNIA

Branches in Principal Oil Centers Throughout the World



From stern to bow along the 420-ton, 174-foot TEXIN: the electric-powered seismic cable reel; shooter's platform; storage racks for charges; starboard firing reel; auxiliary cable reel; jet-engine launches; instrument room; radar room; and bridge.

EXPLORATION at sea...or in shallow water



Remote coastal areas . . . far distant from supply ports . . . are the scene of many seismic surveys. These areas are best worked with the single-ship method of exploration. GSI's *new* TEXIN, similar to her sister ship the SONIC, travels to your prospect under her own power, arriving equipped and provisioned for an extensive offshore program. Auxiliary, jet-engine launches project data-gathering facilities into water no deeper than 18 inches . . . giving you a complete marine survey . . . from deep water to shoreline.

Write now for Bulletin S 60-1, describing both the TEXIN and SONIC.

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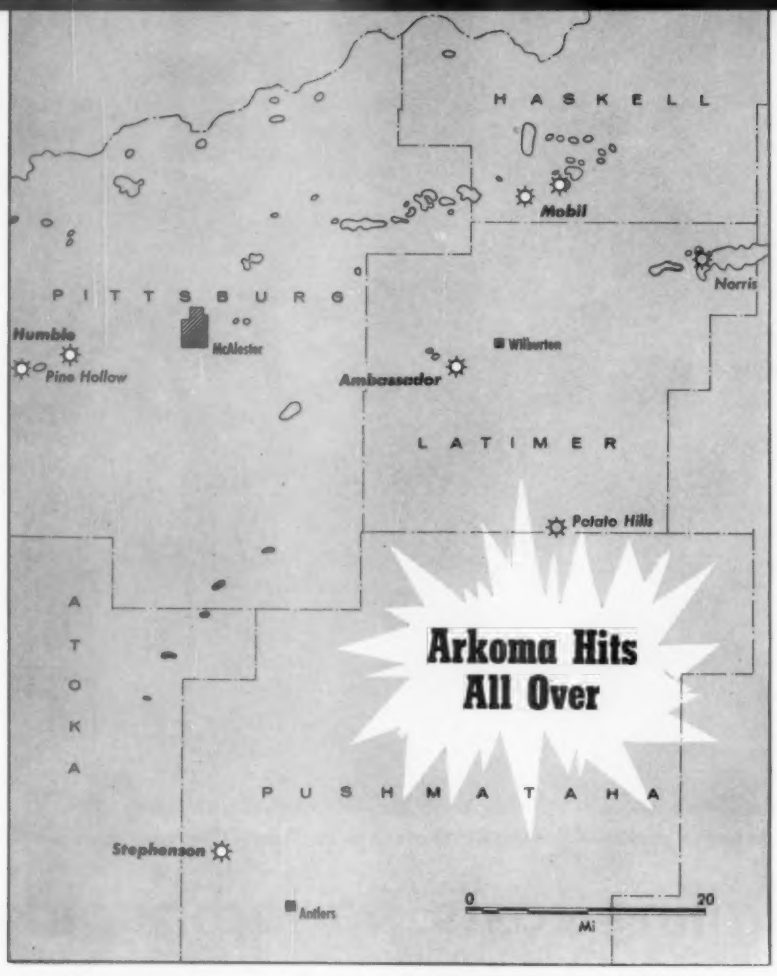


THE ARKOMA BASIN is sprinkled with 1960 discoveries, all gas. Difficult drilling and complex geology are barriers that are slowly being overcome as exploration spreads over more and more of the two-state province.

Eight strikes lend glamour to Arkoma basin's future

BY FRANK J. GARDNER

THE TWO-STATE Arkoma basin, astride the Oklahoma-Arkansas line, has been consistently in the discovery news the past month. And the new strikes, all gas, are widely scattered, lending new importance to the future of the basin.

Eight scattered strikes . . . Most of these new gas fields are in the southeastern Oklahoma sector, as shown on the map. Some are excellent producers, others fair to poor.

One of the poorest is richest in significance, a quite usual thing in the exploration world. This is the recent completion by J. F. Stephenson and King-Stevenson Oil Co. at the 1 Brame, Section 15-3s-15e, in Pushmataha County. This first producer for the county made only 500 M.c.f. per day but its position in the remote Ouachita Mountain country is a stimulant to geologists' belief that the Ouachitas are a potent oil and gas province of the future. The Brame well was nearly a year in the drilling; it was taken to 8,371 ft.

Other Arkoma developments center in Pittsburg, Haskell, and Latimer counties. In Pittsburg, Humble Oil & Refining Co. has two new discoveries west of McAlester.

Exploration Section

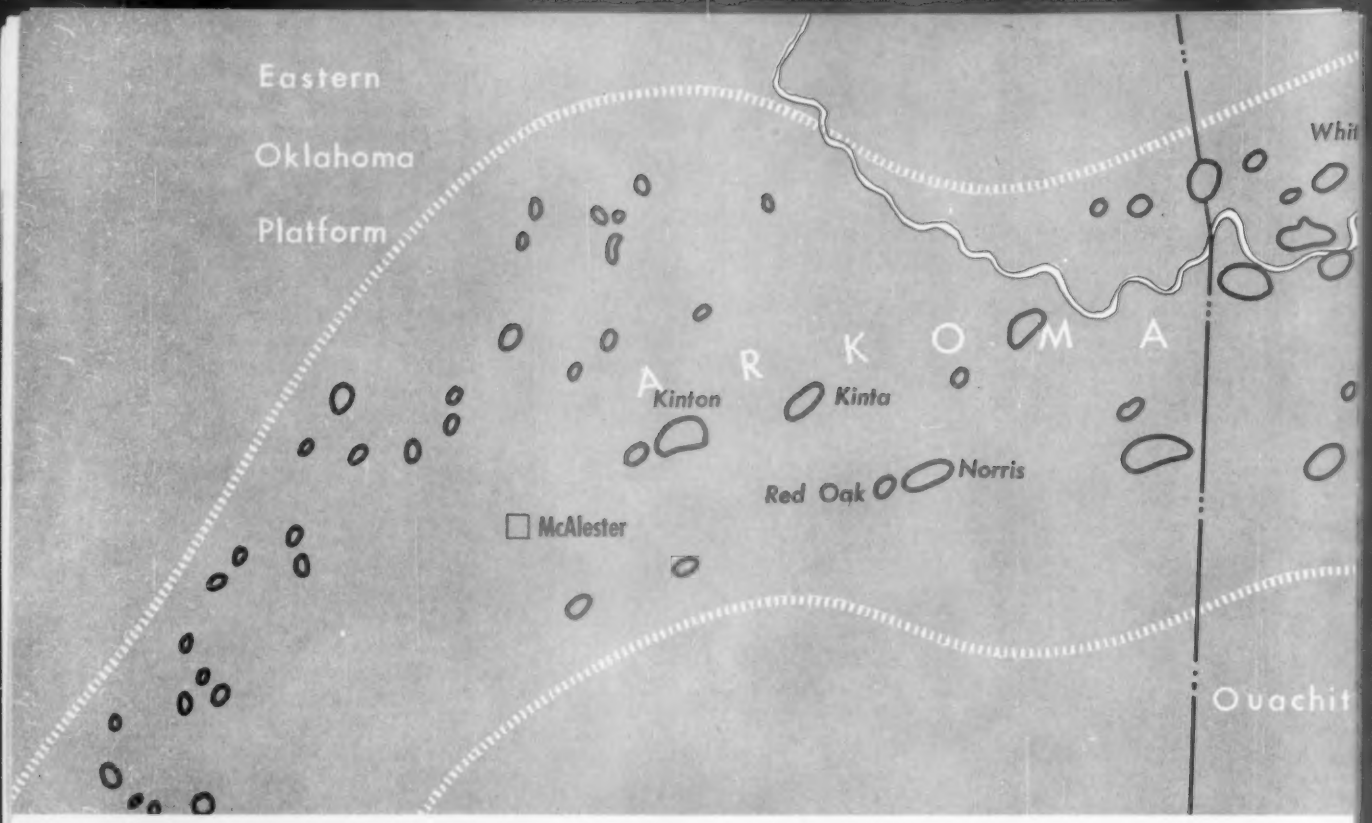
These are the 1 Moran, Section 22-5n-12e, and the 1 Rock, Section 17-5n-13e. The Moran well made 793 M.c.f. per day from Hartshorne-Pennsylvanian at 3,240-78 ft., while the 1 Rock made only 385 M.c.f. from the same formation at 3,414-24 ft.

In Haskell County, Mobil Oil Co. has found good gas showings in its 1 Quinton unit wildcat, Section 11-7n-19e. Here, the Spiro-Pennsylvanian sand has produced as much as 9,500 M.c.f. daily at 5,920 ft. Total depth is 6,149 ft. This discovery lies 2½ miles west of Ambassador Oil Corp. 1 Steele, also a strike, Section 5-7n-20e. The Ambassador well was finished last April in basal Atoka sand at 5,656-78 ft. for 5,200 M.c.f. per day.

Ambassador also has thrust Latimer County into the news with its discovery at 1 Williams, Section 23-5n-18e. This is a deep Spiro producer at 8,811-31 ft., with a recorded natural flow of 5,403 M.c.f. per day through ¾-in. choke, and an open-flow potential of 8,300 M.c.f. The operator took this deep test to 9,704 ft. in Cromwell (Morrowan)-Pennsylvanian sand.

Make the pendulum swing . . . Until 1960, more industry attention was fixed on the Arkansas side of the Arkoma basin than on the Oklahoma side. Now the pendulum swings to the west. Leasing is brisk, drilling is busy, and discoveries are coming. This westward move is largely attributable to two 1960 discoveries: the Sinclair Oil & Gas Co. 1 Reneau strike at Potato Hills, on the Pushmataha-Latimer county line, and the Midwest Oil Corp. 1 Orr on the Brazil (Norris) anticline in northeastern Latimer County. The Potato Hills well made 1,850 M.c.f. daily from Bigfork-Ordovician chert at 2,340-2,410 ft., while the 1 Orr finished for 17,847 M.c.f. from Atoka-Pennsylvanian sand at 7,193-7,330 ft. and Spiro sand at 11,51[illegible]68 ft.

All is not easy in Arkoma exploration, as the next few pages will reveal. But certainly we are looking at a sparsely explored province that is destined to continue in exploration headlines for years to come.



ARKOMA is an apt name for the two-state basin that runs from eastern Oklahoma into Northwest Arkansas. Numerous fields—

High drilling costs, varied geology

BY ROGER N. PLANALP
Geologist,
Athletic Mining & Smelting Co.

THE ARKOMA BASIN is a challenge, a challenge to those who work with it, whether in the production, drilling, or exploration phase of the natural-gas industry.

The two main obstacles to a successful operation in the basin always have been, and still are, high drilling costs and extremely variable geological conditions.

The Arkoma basin is a relatively new name for the combined areas of the McAlester basin of Oklahoma and the Arkansas Valley basin of Northwest Arkansas (Fig. 1). The basin is bordered to the north by the Ozark highlands, to the east by the Mississippian embayment, and to the south by the relatively untested Ouachita Mountains.

The first commercial gas was found in Arkansas in 1902 at Mansfield by the Choctaw Oil & Gas Co., in the Atoka formation. Oklahoma gas production was discovered in 1910, from the Hartshorne sandstones in the Poteau gas field. Both gas fields are still producing gas.

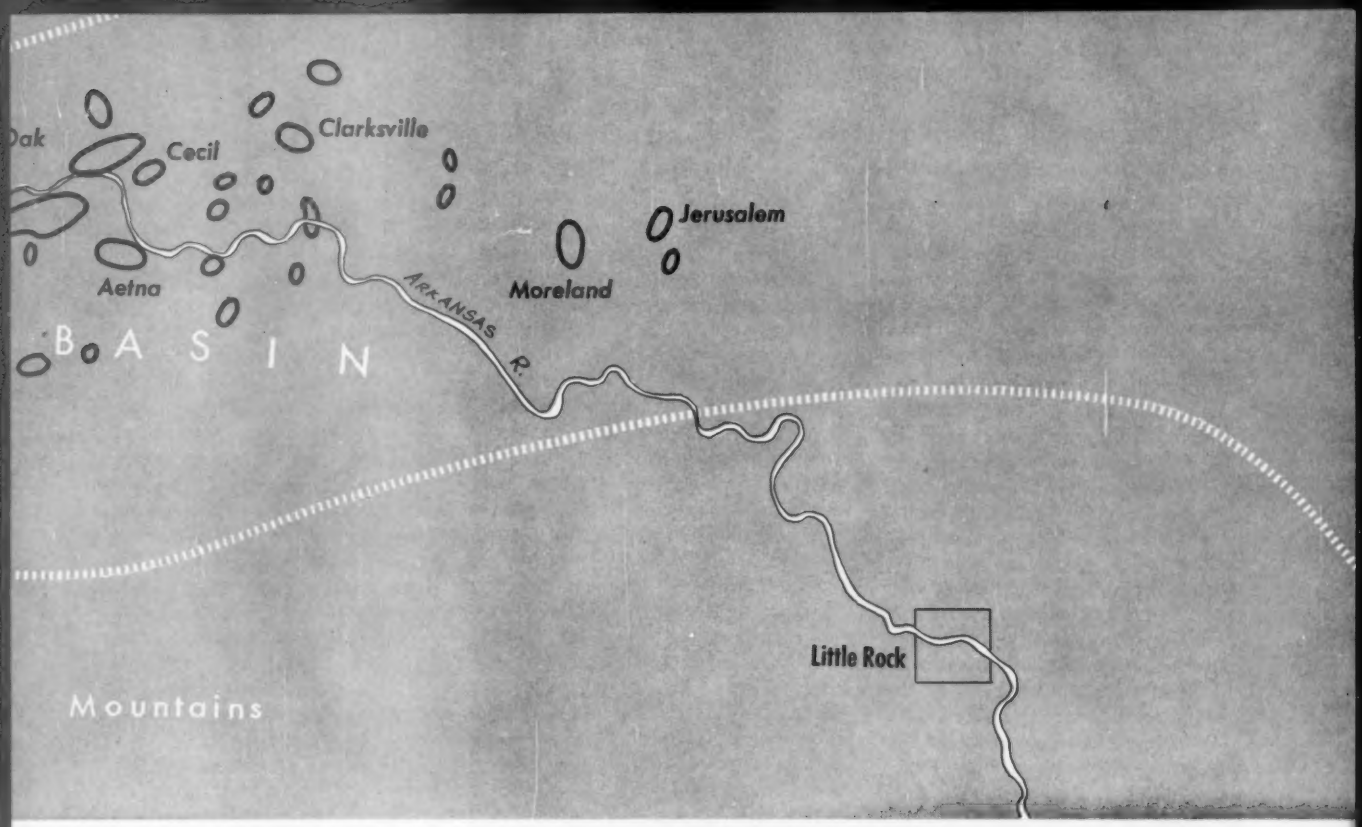
For years the mode of operation in the Arkoma basin was to pick out an obvious anticline, or perhaps obtain an area of cheap leases regardless of structure, and start punching a hole. Total depth was determined by hitting commercial production or the loss of the hole due to cavings or lost tools, or perhaps by the limits of financial backing.

The one well which perhaps did more to change this situation than any was the 1 Ralph Barton, 27-9n-28w, on the Cecil anticline. Arkansas-Louisiana Gas Co. obtained prolific gas production from the lower Atoka sands and also obtained the basin's first commercial Morrow production (1949). Morrow production was found in eastern Oklahoma in 1952 when the Superior Oil Co. 1 Allred, 18-8n-20e, was completed. The following years resulted in more discovery wells in the Arkoma basin, with the Arkansas part receiving the most attention.

This situation was recently changed when the Midwest Oil & Gas Co. and the Frankfort Oil Co. drilled the 1 Raymond Orr, 8-6n-22e in Latimer County. The Orr

About the author...

Since 1957, Roger N. Planalp has been associated with Athletic Mining and Smelting Co. and LeFlore County Gas & Electric Co. He received a BA degree in geology from the University of Missouri in 1952. After working a year with Hycalog, Inc., he completed a masters degree in geology from the University of Missouri. From 1954 to 1957 he was employed by Gulf Oil Corp. in Tulsa, Salt Lake City, Denver, and Fort Smith, Ark., before taking his present post.



mostly gas—are present but it's quite likely that much more gas remains to be found. Fig. 1

fail to slow Arkoma basin growth

well discovered commercial gas nearly a mile deeper than any previous production in the basin, and also encountered bottom-hole pressures far in excess of any previous gage. The Orr well has almost assured the eventual testing of every major anticlinal feature in the southern portion of the Arkoma basin.

Geology

The tightly cemented, resistant sandstones and moderate-to-steep dips result in several hundred feet of relief throughout most of the area. Photogeological interpretation of most anticlines is relatively simple, except for faulting. Considerable faulting is obvious in the field and on the aerial photograph, while other faults are recognizable only by subtle color shading or slight delineations. Subsurface normal and reverse faulting have been found in wells where the fault trace is not recognizable on the surface, indicating pre-Hartshorne faulting may be more common than originally considered.

The surface rocks in the basin are Pennsylvanian sands and shales, ranging stratigraphically from younger to older through the Boggy shale, Savanna sandstone, McAlester shales, Hartshorne sandstone, and Atoka formation. Most wells penetrate the Morrow series of limestones, sandstones, and shales, terminating in the Mississippian-Pitkin limestone.

Dip and strike mapping is the most common method of field mapping. Crossbedding of the McAlester, Hartshorne, and Atoka massive sandstones and the slumping of shales are drawbacks to this type of work. Planetable mapping is not only impractical due to the heavy foliage and rough terrain, but is also unnecessary in most instances as surface closure of most Arkoma basin anticlines can be measured in the hundreds and sometimes thousands of feet.

Subsurface geology in the basin has been limited by poor logs and sparse control. One disadvantage subsurface geologists will probably always have, especially in the Arkansas area, is the lack of good logs on the upper portion of the hole, as present drilling techniques make shallow logging often impractical. A correlation chart of the lower Atoka and Morrow gas sands of Northwest Arkansas has been published recently by the Fort Smith Geological Society (Fig. 2). The type log of Aetna field is representative of the stratigraphic column in the Arkansas portion of the basin.

Thirteen sands have commercial production in this field, with a maximum calculated flow from one zone of over 50 M.M.c.f. The sands become more obscure toward Oklahoma and from the state line west many Atoka sands are missing. The major share of gas production throughout the Arkoma basin is in the basal Atoka sands. In Arkansas the lower Atoka section (Cecil-McGuire) is also a prolific zone, and considerable production is obtained in the upper Atoka sands and Morrow sands.

Oklahoma production is from the Hartshorne sandstone, numerous minor shallow Atoka zones, Cromwell production (Hale), the recently discovered Red Oak sand (Atoka), which has the highest pressure gradient of any well in the Arkoma

"With the possible exception of the geology, no phase of the Arkoma basin represents as serious a challenge to the operator as drilling."

basin, and the prolific basal Atoka sandstone commonly called Spiro.

Drilling

With the possible exception of the geology, no phase of the Arkoma basin represents as serious a challenge to the operator as drilling. One of the most advantageous approaches to cheap drilling costs is to have a relatively flexible casing program and flexible operating procedure. Most geologists who have worked the area consider every well to be at least a semiwildcat, if not a wildcat. Every hole will vary, not only in the amount and location of gas production, but also in the amount and location of water sands.

Although often geologists are not concerned with the drilling problems and operations, in the Arkoma basin use of all subsurface geological information available is a necessity for competent operations. This is especially true in the Arkansas portion of the basin where there are numerous water sands through the drilling section. The miscalling of a casing point above a water zone can very quickly change the drilling costs from $5 to $50 a foot.

Three main drilling procedures that are commonly practiced in the Arkoma basin are listed below.

1. Cable tools from surface to total depth. Used predominantly in areas of high sand content and abundant water horizons.

2. Rotary (air or gas) from surface to total depth. Used predominantly in areas of thick shales and no water sands.

3. Cable tools from surface through the lowest water sands and to a depth beyond which cable tools are not economically competitive with rotary. Rotary (air or gas) from cable-tool depth to total depth, used in many areas of hard surface rocks (ex. Hartshorne sandstone) and in areas of abundant shallow-water horizons.

The basic problem of all these drilling methods is very hard shallow sands and unpredictable water zones. When spudding stratigraphically high in the section (Hartshorne or Younger) more drilling difficulties are generally encountered. The development of the percussion tool to overcome hard shallow sands is hoped to make the rotaries more competitive with cable tools at shallow depths.

Several excellent increases in penetration in the drilling of surface holes have been made with the percussion tool. Improvement of this tool and the usage of it where less costly failures occur, would eventually result in an over-all savings to operators over conventional drilling.

Water zones can be handled by mist or aerated drilling, water shutoff chemicals, or by running casing and reducing the hole size. Water shutoffs have been perfected to where 75% success is claimed, which would probably be a satisfactory percentage if the 25% failures did not often result in stuck pipe. There is no cheap way of handling a water problem and what often seems the most expensive way (running of casing) is very often the cheapest.

Considerable difficulty by several operators has been encountered in the air drilling of wells due to excessive condensation, especially in the summer months. If downhole condensation is misinterpreted as formation water, and the well is mudded up, the resulting increase in drilling costs is tremendous. The opposite is true where formation water is encountered and air-gas drilling is continued until the drill collars are planted.

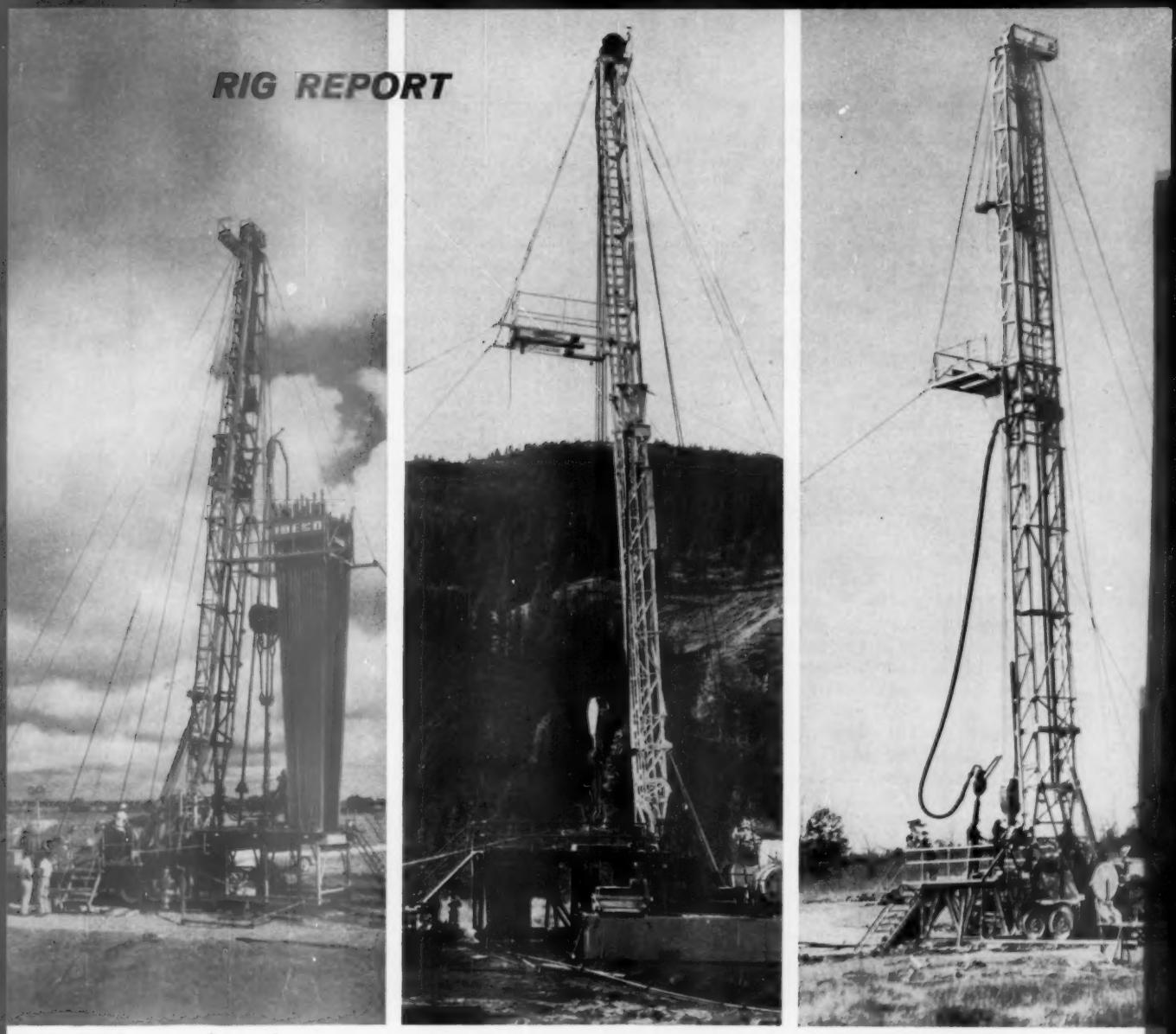
Two main factors which increase drilling costs are hole deviation and high bit costs. Hole deviation is common both to cable and rotary drilling. The hard formations necessitate maximum weight on the rotary bit for good penetration rates. The hard sands and alternating soft shales, steep dips, and faulting all contribute their share of hole difficulty. Cable-tool operators have the advantage of knowing immediately when the hole is becoming crooked, and can take corrective measures depending, of course, on the individual case and on the contractor.

Rotary-hole deviation has been reported in excess of 25° at 6,000 ft. Fortunately, the crooked hole does not cause any unsurmountable obstacles to the completion of a gas well. One of the most popular accessories to rotary drilling is the automatic driller. The automatic driller is a necessity with percussion-tool equipment. Many operators feel that the automatic driller does much to overcome the problems of crooked hole and high bit costs.

Bit costs are extremely high in conventional mud drilling, and often are very high in air-gas drilling, especially in Franklin, Logan, Johnson, and Pope counties, Arkansas. Tungsten-carbide button bits, if used when needed, can save considerable time and money. Geologists can reduce the drilling costs by predicting the general sequence of rock units. The hardest of steel-tipped bits have worn out completely in 2 hours of drilling. Thousands of feet of shale have been cut with the expensive tungsten-carbide button bits, resulting in unnecessary drilling costs. Unfortunately, it is not always possible to give the geological control necessary, as faulting will either cause loss of correlation or unknowingly, the control well was faulted. It would be difficult to overemphasize the role of the well-site geologist in helping with the drilling operations.

Logging

Any geologist who works the Arkoma basin will quickly notice the inconsistency of logs in the area, not only from field to field, but by operating companies. This inconsistency of logging reflects the inconsistency of hole conditions. The induction log gives the geologist a good correlation log, whether the hole was logged with or without fluid in the hole. A reliable porosity-permeability log is more difficult to obtain. The three main bore-hole conditions encountered for logging are an empty hole, a mud-drilled hole, and an empty hole which was mudded up at total depth. In the empty hole, the temperature log is an excellent detection tool for small gas zones which are masked by larger zones or by drilling gas. The top and bottom of the permeable zones are also defined. The density type of tool has given good porosity readings if the hole is in good gage. The contact-pad type of log is still generally preferred in mud-



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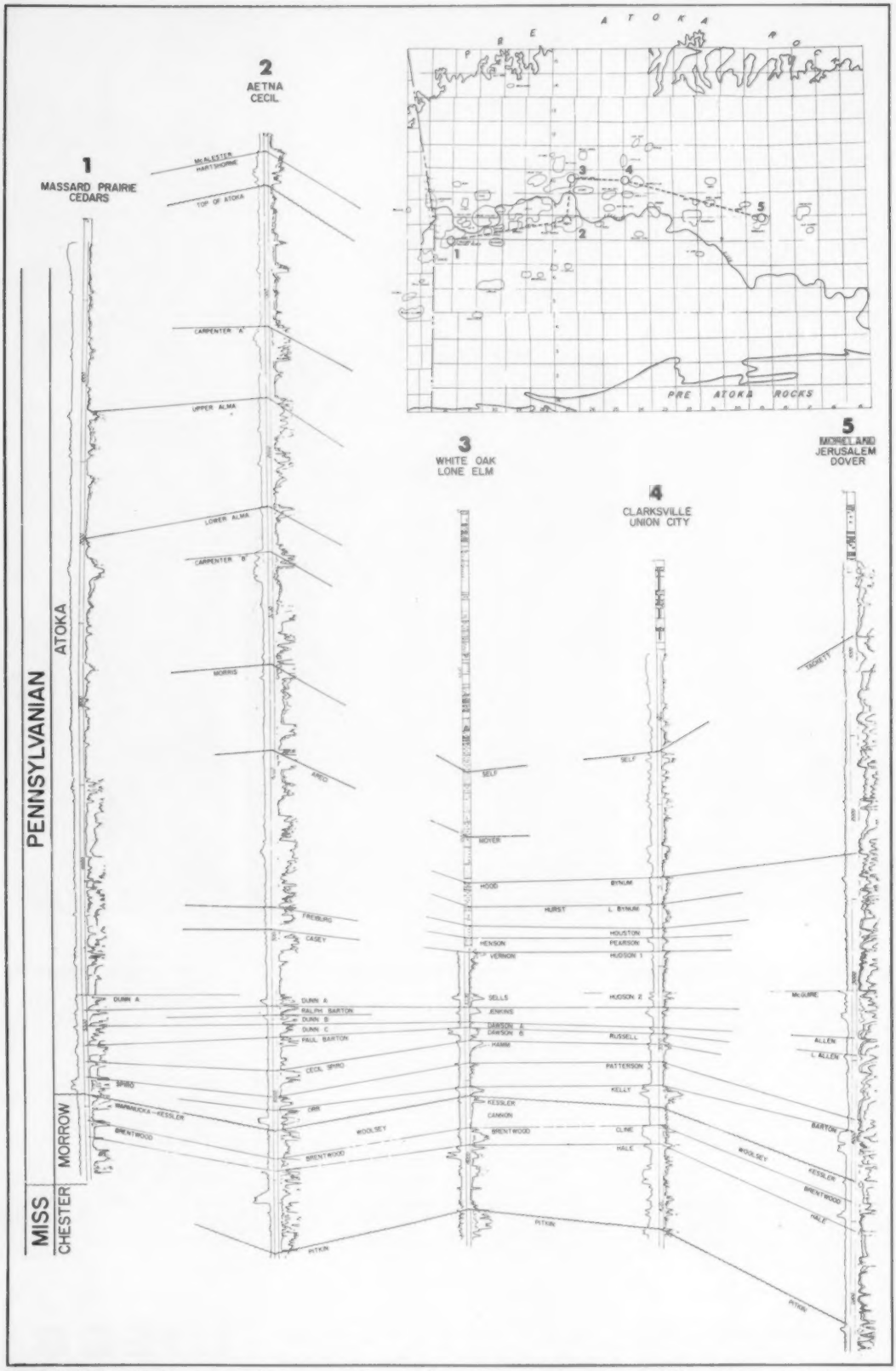

CORRELATION CHART of the Arkansas portion of Arkoma basin displays the multiplicity of targets in the upper portion of the section. What the area needs most is greater drilling density and deeper probes to learn the true potential the basin will yield. Fig. 2.

filled holes, especially where the gas zones were mud-drilled. Some operators prefer to also run a velocity log to determine porosity if there is doubt about the interpretation.

Several operators have encountered indicated contact log permeability in wells which were air drilled and did not produce any gas or water. Also the opposite of this situation has been encountered, where core analysis showed porosity and permeability that did not record on the contact log. The latter case can perhaps be explained by extremely low permeabilities, very low water-loss mud, insufficient circulating time or combinations of these conditions.

Flexibility of logging is necessary, especially in the empty holes. The one logging tool recommended in empty holes, if the bore hole is making gas, is the temperature survey. The temperature survey readily picks up all permeable zones which might be masked by a large flow of gas above. After the logs are obtained, the combination of samples, drilling time and logs are often necessary for a final opinion.

Completions

Well-completion costs in the Arkoma basin very often will equal or be greater than the drilling costs of the well. One risk factor present throughout the basin and in particular in the southwestern part is the black caving shale which is so characteristic of the lower Atoka section. Cementing of intermediate strings, liners, and production strings all pose the risk of lost circulation, plugged cementing tools, bridged holes, and stuck pipe. The drilling problems sometimes necessitate more hole reduction than is desirable from a production standpoint, thereby multiplying completion-work problems.

Athletic Mining & Smelting Co., Fort Smith, operators of Aetna field in Franklin and Logan counties, Arkansas, are completing dual, triple, and quadruple cementing tubing strings and oriented perforating. Perhaps the largest drawback to this type of completion is the restricted annulus which reduces injection rates of fracturing. The savings in original completion costs and the permanency of the completion makes this type of completion very desirable. Several operators are having to rework multiple-completed wells after several years, primarily because of packer failures or the sand blasting of holes in tubing opposite perforations which were fractured with sand.

"Well-completion costs in the Arkoma basin very often will equal or be greater than the drilling costs of the well."

Fracturing

Some individuals refer to fracturing as a panacea for all low-open-flow wells in the Arkoma basin. In reality some very good results have been obtained from fracturing; however, in other cases no open-flow increases were obtained, and in other instances possible harmful results were indicated by a reduction in open flows. The calcareous basal Atoka and Morrow sands definitely show the best average open-flow increase after fracturing. Several instances of excellent increases in open flows were obtained after a second fracture treatment was performed.

Outlook

The main outlet for gas in the Arkoma basin is Arkansas-Louisiana Gas Co. with two main lines in Arkansas and Oklahoma Natural Gas Co. in Oklahoma. There has been considerable speculation of additional pipelines coming into the area for several years, but to date nothing has materialized. Four local gas companies have pipeline systems in the area. Arkansas Western Gas Co., Fayetteville, and Fort Smith Gas Co., Fort Smith; both serve northwestern Arkansas towns. Eastern Oklahoma gas is supplied by LeFlore County Gas & Electric Co. of Poteau, and Tri-Cities Gas Co. of Hartshorne, Okla., operates between Wilburton and McAlester, and by Fort Smith Gas Co.

Large-scale leasing occurred in Arkansas in 1951, 1952, 1953, 1957, 1958, and 1959. Oklahoma leasing has been scattered through the years until the 1 Raymond Orr in Latimer County precipitated a large lease play in 1958 and 1959. Almost all readily available acreage in the Arkoma basin has been leased.

Many operators believe Arkoma basin drilling will increase in the next few years; others think it will maintain a steady pace. Many advances in the methods and techniques of drilling have been made in the past few years. There still is a challenge to further improvement of penetration rates, especially in the Arkansas area, and to overcome the caving problems of the lower Atoka shales in the Oklahoma portion. Geologists are faced with the challenge of unraveling the mysteries of structure, stratigraphy, and in particular porosity trends. The Arkoma basin will always present a challenge to operators working in the area.

Acknowledgment

Many of the opinions expressed in this paper are drawn from the experiences of Raymond F. Orr, president; James F. Orr, and the staffs of LeFlore County Gas & Electric Co., Athletic Mining & Smelting Co., and Rox Drilling Co. These companies have drilled over 500,000 ft. of hole in the Arkoma basin in the past 40 years.

The correlation chart is available from Fort Smith Geological Society, Box 1123, Station "A," Fort Smith, Ark.

Wyoming's Wallace Creek discovery is completed

Final completion and shut-in is reported at an important Wind River discovery, Wallace Creek. The Natrona County, Wyoming, discovery is National Cooperative Refinery Association 1 Wallace Creek unit in SE SW 22-34n-87w.

Final gage was 80 bbl. of 34.4°-gravity oil and 1,470 M.c.f.d. from perforations in the Muddy Cretaceous zone of Thermopolis shale at 10,345-61 ft. Initial tests at this discovery last fall made up to 59 bbl. per hour on drill-stem. Nearest Muddy production is 17 miles southeast at Grieve field. Raderville field is the nearest production, 10 miles northwest.

Ellenburger well flows in West Central Texas

Antelope Gas Producing Co. 1 Adrian Estate flowed 10 bbl. of oil per hour from Ellenburger Cambro-Ordovician open hole section at 6,266-85 ft. Location of the new discovery is in Nolan County, 9 miles southeast of Sweetwater in Section 55, Block 20, T&P Survey, 2 miles east of depleted Ellenburger production. Testing continues.

Look to Rockies and Texas for '61 news

Paradox, Williston, and Delaware are the ones to watch

HALF A DOZEN regions on the North American Continent will steal the exploratory prizes this year. There may be more, but these six areas should lead the year's wildcatting race—the Rocky Mountain states, Texas, Oklahoma and the Mid-Continent, British Columbia, Williston, and California. These predicted newsmakers had sound exploratory programs last year with important discoveries that will sire this year's wildcatting and subsequent development.

Lisbon news may grow old

. . . but the significance of this major Rocky Mountain oil and gas discovery is yet to unfold. Discovery of oil and gas in Devonian and Mississippian early in 1960 at Lisbon in Utah and Southeast Lisbon in Colorado gave Paradox basin its biggest story since Aneth. With 1961 only 2 days old this Lisbon anticline reservoir is still in the infant stages of its development. It will be some time before the whole truth of its worth is unfolded.

Wyoming will retain laurels

. . . as explorers continue to blast away at the hidden reserves of Green River and Powder River basins. Large as it is now, the Arch Unit area of Sweetwater County is still barely tapped. Rocky Mountain enthusiasts believe that this long producing area with its big Almond Cretaceous sand oil and gas wells has a long time to go before final proving.

The Muddy and Dakota sands plus Pennsylvanian Minnelusa, not new to Powder River, but growing in reserve importance, can look for a bigger year than last. The entire northeast side of this big Wyoming basin is fast becoming an important producing area of the Rockies.

Texas barriers are falling

. . . by the wayside in the deep, remote Delaware basin and along the growing Deep Edwards trend. Discovery of the first Pennsylvanian production (Texas' deepest producer) last year in Pecos County for the Texas side of Delaware basin set off a flurry of deep wildcatting that uncovered several new fields in both Pecos County and across the state line into New Mexico. Ellenburger discoveries in the so-called Sheffield Channel will get confirmation attempts this year.

The deep Edwards trend in Southwest Texas is one of the most significant wildcat frontiers in the business. A stretch of Texas brushland extending from the Rio Grande northeastward 200 miles to the center of Lavaca County has been brought to industry attention by a series of deep Edwards oil and gas discoveries in recent months. It is still to early to tell how far this trend will go. Production has been obtained from 9,000 ft. to below 14,000 ft., and deeper possibilities are indicated.

Oklahoma and Nebraska exploration

. . . will center in three basins, the Anadarko, Arkoma, and Kaneb. Three deep wildcats are slated for far western Oklahoma in the very middle of the Anadarko trench. All will go below 15,000 ft. On the opposite side of the state, the Arkoma basin is on its way up as a major new gas province for the nation. Its development is newborn, but 1961 should tell just how important this once unknown basin is to the industry. Nebraska's Kaneb basin, a two-state affair, may develop into a more important oil-producing area than the Denver basin. For 2 years the Kansas side of the basin held the top rung, but last year's Cambrian and basal Pennsylvanian discoveries in Nebraska changed all this. This year's activity may place it high in regional statistics.

The frozen Fort Nelson area

. . . in northeastern British Columbia is in the midst of what promises to be its busiest drilling season to date. Kotcho Lake and Petitot River started the fanfare 2 years ago. So many tests are slated for this seasonal drilling area of Canada that a rig shortage exists. More than 20 wildcats will discover gas or fail in this Canadian corner this winter.

Montana should grab Williston

. . . exploration interest this year. The Tule Creek discovery and its many followups strive to bring Devonian production up to par with the mighty Mississippian output in Williston. Murphy's discovery well was the best yet for Devonian finders in the basin. Development around this Williston niche will be watched closely.

California moves into Sacramento

. . . as gas replaces oil as the big target on the West Coast. Sacramento Valley is growing into a leading U. S. gas reserve. Its growth has taken some time, but 1961 should give us a good idea of just how big Sacramento's gas reserves might be.

—John C. McCaslin

Production reported at Southwest Kansas wildcat

Mississippian production is reported at a wildcat in southwestern Kansas, 14 miles southeast of Hugoton in Stevens County.

The discovery well is Cities Service Oil Co. 2 Taylor "C," C SE NW 23-34s-35w, 6 miles southeast of Walkemeyer field. The well flowed 4,870 M.c.f.d. from Chester Mississippian perforations at 6,420-34 ft.

Barton County. Messman-Rinehart Oil Co. completed 1 Unruh "B" in Barton County flowing 2,250 M.c.f.d. from Arbuckle Cambro-Ordovician perforations at 3,796-3,813 ft. Location is in NE NE NW 29-20s-15w, ½ mile south of Converse field. The well extends that field.

Harper County. Pickrell Drilling Co. revived production in a depleted section of Spivey-Grabs field at 1 Rall "C," NW NW SW 26-31s-9w, ½ mile from production in the southwestern part of the field.

The well flowed 80 bbl. of oil and 198 M.c.f.d. from Mississippian perforations at 4,416-22 and 4,425-30 ft. Allowable is 40 bbl. daily.

Clark County. Sinclair Oil & Gas Co. will complete 1 Randall in C SE NW 32-34s-21w, southwestern Kansas. The well flowed 1,200 M.c.f.d. and 76 bbl. condensate in 5 hours through ¾-in. choke from Lower Morrow Pennsylvanian sand at 5,516-32 ft. The Upper Morrow sand got 1,350 M.c.f.d. and 90 bbl. condensate in 8 hours from 5,489-5,501 ft. Location is in an extension area of Southwest Snake Creek field.

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Important Abo reef well may offset discovery

The ¼-mile northeast offset to 2 Vacuum Edge unit in southwestern Lea County, Southeast New Mexico flowed oil on tests of the Abo reef. This important find is Standard Oil Co. of Texas 3 Vacuum Edge unit. Flow was 336 bbl. per day through ½-in. choke during tests at 8,427-8,537 ft. Location is 20 miles northwest of Hobbs in 4-18s-35e.

Chaves County. A Central Chaves County wildcat was completed as a San Andres discovery. Well is M. R. Voltz 1 Kenneth V. Barbee, 6 miles southeast of Roswell in 9-11s-25e, 8 miles northwest of Dexter field.

The well pumped 13 bbl. of oil per day from perforations at 892-912 ft.

Another big well finaled in Kingfisher boom area

Oklahoma's prolific Kingfisher County trend picked up another big producer at Jones & Pellow Oil Co. 1 Pacula in C SW NW 6-19n-5w, East Hennessey field.

The well flowed 1,548 bbl. of oil per day on ¾-in. choke from Cleveland sand perforations at 5,722-55 ft. Meramec Mississippian got 96 bbl. per day on 20/64-in. choke from open hole at 6,453-6,525 ft. Plans are ready for 2 Pacula in C NE NW 6-19n-5w.

Garvin County. Bromide Ordovician oil pay is confirmed at Southwest Whitebead pool in Garvin County, South Central Oklahoma.

The new area's confirmation well is Huffman & Malloy 1 Gorden in NW NW SE 21-3n-1w, northeast offset to the field discovery. It flowed 66 bbl. of 40°-gravity oil in 15½ hours on 14/64-in. choke from perforations at 4,840 ft. Another test made 30 bbl. in 15 hours on ⅛-in. opening. Pure Oil Co. 1 O'Harro was discovery well in SE NE SW 21. It was completed for oil in first and second Bromide sands.

Seminole County. Humble Oil & Refining Co. completed a new pay discovery in old Keokuk field, Seminole County, East Central Oklahoma, reviving the old area.

The 6 Riddle in N½ SE SE 35-11n-6e, pumped 54 bbl. of oil per day from Wilcox Ordovician perforations at 4,362-80 ft. The well was drilled back in 1935 originally to 4,050 ft. Completion was 10 bbl. per day from Misener-Hunton Siluro-Devonian pay.

Texas County. Out in the Oklahoma Panhandle, Shell Oil Co. completed 1 Schaffler inside the shallow Permian Hugoton gas field area. The well flowed 2 M.M.c.f.d. on 43/64-in. choke from Keyes sand perforations at 6,452-98 ft. A second Pennsylvanian zone, upper Morrow, was good for 600 M.c.f.d. and 9 bbl. condensate on 20/64-in. choke at 6,116-38 ft. Location is 3 miles northwest of other deep production.

Montana extension well completed in Ratcliffe

A Ratcliffe zone of the Madison Mississippian success is reported at Sun Oil Co. 1 Brinkman in C SE SE 14-32n-58e, Sheridian County, northeastern Montana.

The extension strike flowed 366 bbl. of oil per day through 20/64-in. choke from perforations at 7,793-7,811 ft. This new field was opened by Signal Drilling & Exploration Co. with production of 150 bbl. per day from 7,749-75 ft. at the well.

Wolfcamp gas discovery in Sheffield area

Another discovery is reported in the Sheffield Channel area of Terrell County, far West Texas. Indicated strike is Sinclair Oil & Gas Co. 1 Annie Spencer, 25 miles southwest of Sheffield. A drill-stem test in the Wolfcamp Permian at 6,473-6,525 ft. got 588 M.c.f.d. and 93 ft. of gas-cut mud. Location is about 6 miles west of 1 Poulter, another indicated gas producer from both Wolfcamp and Ellenburger. The Spencer wildcat is located in Section 53, Block 1, TCRR Survey.

Pecos County. The extension try to newly opened Yucca Butte field, 6 miles southwest of Sheffield, flowed gas on drill-stem tests of the Pennsylvanian detrital zone.

Shell Oil Co. 1-A Blackstone-Slaughter, 1 mile west of the big discovery well, flowed 3,240 M.c.f.d. from 8,481-8,560 ft. on one test. Operator is now drilling below 8,584 ft. This important confirmation well is located in Section 18, Block A-2, TCRR Survey.

Discovery wells

CALIFORNIA

Riverside County:
- Alpoil Co. 1 Gov. T.M.P.C., SW SE SW 17-2s-7w. Pumping 12 BOPD after blowing tools out of hole while swabbing, 25°-gravity crude from 2,758-3,125 ft. TD 3,569 ft. New field discovery in Prado Dam area. Nearest production 1 mile east.
- Alpoil Co. 1 Sardo, NE NW NW 20-3s-7w. Pumping 141 bbl. daily of 30.7° crude with 12% water cut from Puente formation, Upper Miocene through perforations at 3,320-3,603 ft. New zone discovery in Prado Dam area.

Solano County:
- Reserve Oil & Gas Co. 2 Liberty, NW SE SE 19-5n-3e. IP 4 M.M.c.f.d. from Eocene sand through ⅜-in. choke. Perforations at 4,726-44 ft., 4,755-63 ft., and 4,773-83 ft. TD 6,500 ft. New field discovery.

Sutter County:
- Buttes Gas & Oil Co. 2 Natomas, SW NE NE 5-10n-4e. No dope hole completed as gas well in two zones. TD 4,580 ft., 4½-in. casing to 3,480 ft. New field discovery.

WESTERN CANADA

Alberta:
- Texaco 5-17-20-28 Okotoks, LSD 5, 17-20-28w4. Oil discovery, TD 7,436 ft.
- Amerada Crown CD 5-35-82-3 Bingo, LSD 5, 35-82-2w6. Triassic gas discovery. TD 7,561 ft.
- Western Dynamic 10-25-22-8 Jenner, LSD 10, 25-22-8w5. Gas discovery. TD 3,010 ft.

Saskatchewan:
- Ambassador 9-20-8-8 Stoughton, LSD 9, 20-8-8w2. Frobisher oil discovery. TD 4,215 ft.

WYOMING

Weston County:
- True Oil Co. 1 Dorsey, C NW NW 12-48n-68w. IPP 120 BOPD, Muddy 6,265-75 ft. TD 6,640 ft. Muddy discovery, new field.

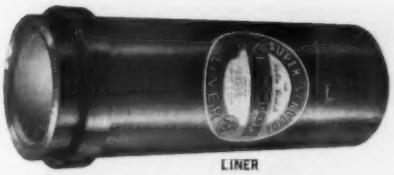
NEW MEXICO

Chaves County:
- M. R. Voltz 1 Kenneth V. Barbee, 6 miles southeast of Roswell in 9-11s-25e. IPP 13 BOPD, 11 BW/24 hours, 32°, San Andres 892-912 ft. TD 930 ft. PBTD 918 ft. New oil discovery.

Eddy County:
- OWPB. Shell Oil Co. 1 Henshaw deep unit, 10 miles northeast of Maljamar in 24-16s-30e. IPF 171 BOPD, plus 3% water, 18/64-in. choke, 36.3°, GOR 1,377:1. TP 360 psi. packer. Pennsylvanian 8,822-30 ft. TD 13,072 ft. PBTD 8,845 ft. New oil discovery.

Lea County:
- Continental Oil Co. 1 East Gladiola unit, 6 miles northeast of Gladiola in 34-11s-34e. IPP 110 BO and 680 BW in 24 hours, 47°, Devonian 12,081-89 ft. TD 12,135 ft. New oil discovery.
- Continental Oil Co. 1-30 Russell Federal, 30 miles southwest of Jal in 30-26s-32e. IPP 42 BO and 80 b.s. and w. in 24 hours, 40°, GOR 345:1. Delaware sand 4,226-31 ft. TD 4,400 ft. PBTD 4,245 ft. New oil discovery.

(Continued on page 145)

The Mission  Mission

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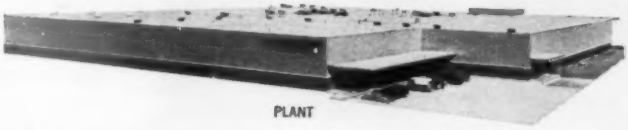
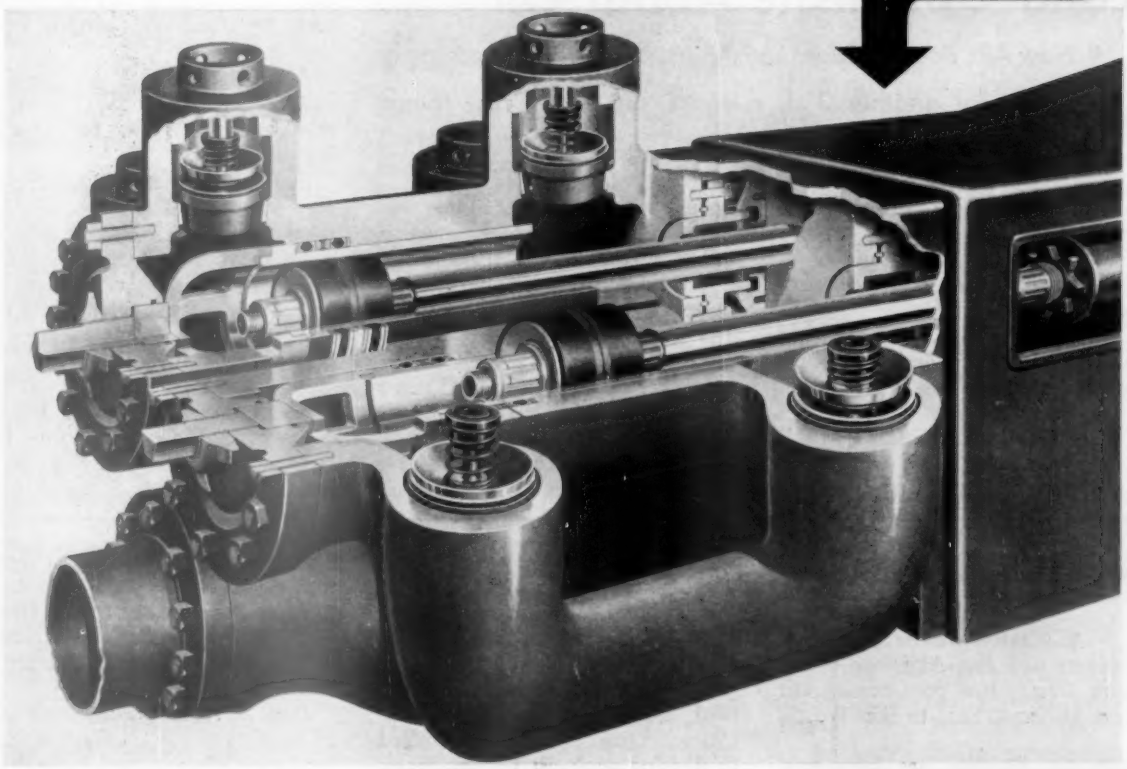
are all designed and made in our modern  to work together to cut your drilling costs.

PLANT



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Gage Lund . . . the API's new production vice president.

Lund Optimistic About Oil

- New API vice president says there may be an oversupply of crude for another 3 or 4 years, but sees many things which point to a bright future for the industry.

IF YOU WANT an optimistic view of the oil business, talk to Gage Lund new vice president of production for the American Petroleum Institute.

Lund is fully aware of the tight situation facing the industry today. In fact, in his job as a vice president and director of Standard Oil Co. of California he faces worldwide producing and exploration problems which daily point up the current over-supply of crude oil. He expects the oversupply situation to last another 3 or 4 years if current conditions prevail, but he sees plenty of signs pointing to a healthy and growing oil business.

The veteran oil man says he can remember two times in his 35 years in the industry when conditions were as tough as they are today.

As an example, he cites his days in West Texas during the early 1930's when he was a drilling superintendent for one of Socal's subsidiaries. He was making $325 a month when the bottom fell out of things. The company spread out the work and cut the work week rather than lay off employes. His salary dropped to $280 as a result.

"And it took me 8 years to get back up above $300," he adds.

Since Lund knows tough times his optimistic view is not colored by work in just the plush years of the oil business.

Too, he points out the industry could jump from an oversupply to an undersupply situation if one of the big Middle East producing countries defects to the communists. He doesn't say this will happen, but does point out that four of the countries are producing in excess of a million barrels a day. The free world would be called on to make up the difference should one of these countries defect, and the industry would be facing another Suez situation.

How to save . . . The industry is over the hump as far as cutting costs by trimming payrolls, Lund says.

Additional savings are possible and needed, but it boils down to finding and producing oil more efficiently.

Standardizing materials is one way Standard of California has managed to trim costs, he says. By using the same tubing program in different parts of the country, the company can move tubing from one area to another if a promising play fails to materialize.

And research is paying off for Socal. Lund says studies by the company showed platforms had been overbuilt for wave stress in the Gulf of Mexico. Some platform

▶▶▶ Personals

E. V. (Corky) Weaver, petroleum engineer with Pan American Petroleum Corp., has been transferred from Midland, Tex., to Fort Worth.

D. O. Popovac has been promoted to assistant superintendent of Continental Oil Co.'s industrial-alcohol plant now under construction in Lake Charles, La. He had been superintendent of the research and development process laboratory in Ponca City, Okla.

Benjamin F. Baldwin, district exploration superintendent in Lubbock, Tex., for Pan American Petroleum Corp., has been promoted to division geologist for the North Texas-New Mexico division in Fort Worth. He succeeds **William T. Smith,** who recently was named division exploration superintendent.

Albert D. Johnson, district superintendent for Amerada Petroleum Corp. in Seminole, Okla., and **Henry T. Stewart,** district superintendent in Casper, Wyo., retired January 1.

Isaac A. Ault, offshore supervisor of Mobil Oil Co.'s Lafayette, La., producing district and pioneer in offshore operations, has retired after 39 years with Mobil. In 1946, Ault was in charge of the first Gulf of Mexico offshore test for Mobil.

modification resulted in construction savings.

The markets . . . Lund sees growing markets throughout the developed parts of the world and potential markets in undeveloped areas.

He says South America has a tremendous potential market. A peon today may be plowing with a crooked stick and piece of iron. Tomorrow, he will use a tractor if he can come up with the money to buy one.

And he says this prospect can be repeated in most parts of the undeveloped countries, and result in new and expanded markets for oil.

Background . . . When the API picked Lund as its production vice president last month in Chicago, it got one of the top production men in the business and a man whose experience ranges from the rig floor to the executive suite.

Lund is credited with laying much of the foundation for what is now Standard of California's operations in Texas, the Gulf Coast, and the Rocky Mountains.

He joined the company in 1925, a year after completing his studies in chemical engineering and geology at Montana State College and Stanford University. His first assignments were in the Rockies and Texas as a geologist and drilling foreman.

By 1938 he worked up to assistant manager of all operations for both The California Co. and Standard Oil Co. of Texas. He was elected president of Calco in 1941 and 4 years later was named chairman of both Calco and Standard of Texas.

Lund moved to San Francisco in 1948 when he was named a director of the parent company. Later that year became a vice president.

Robert R. Roady, geologist with Sohio Petroleum Co., has been transferred to Houston from Oklahoma City.

Edwin O. Bennett, Houston consultant, has been named 1961 recipient of AIME's Anthony F. Lucas gold medal. The award cites Bennett's development of gas pressure-maintenance techniques and his work with multiple-completion methods. Bennett had been with Standard Oil Co. of California, the Bureau of Mines, and Continental Oil Co. before forming E. O. Bennett & Associates in 1943. He is a past recipient of the Hanlon award for service to the natural-gasoline industry.

Lloyd H. Ketchum, Jr., engineer trainee with Ohio Fuel Gas Co., has been promoted to junior engineer in Norwalk, Ohio.

George B. McKinley, president of First National Bank, Glenwood Springs, Colo., has been elected president of Garfield Gas Gathering Co. and Garfield Gas Producing Co., Inc., Glenwood Springs.

Frank A. Moore, staff assistant to the president of Marathon Pipe Line Co. has been named acting assistant manager of the company's Rocky Mountain region. He will move to Casper, Wyo., from Findlay, Ohio. Moore succeeds **M. E. Parker,** who is on loan to Oasis Oil Co. of Libya, Inc., another Ohio Oil Co. affiliate. **William B. Read,** supervisor of Marathon Pipe Line's engineering department, will succeed Moore as staff assistant to the president. **R. L. Linville,** supervisor of the regional pipeline-engineering department, has been transferred from Casper to Findlay, succeeding Read. **Richard Englum,** pipeline engineer in Casper, has succeeded Linville there. Also, **John B. Redpath,** project engineer for the pipeline company, has been appointed technical adviser, a new position. He will continue to headquarter in Findlay.

John N. Troxell, general manager of the domestic producing department of Texaco Inc. in Houston, has retired after 38 years with the company. **Homer O. Woodruff** was previously named to succeed Troxell.

G. Bowen Davidson, party chief for Mobil Oil Co. in El Paso, Tex., has been promoted to senior geophysicist in Roswell, N. M.

I. E. Killian, manager of Humble Oil & Refining Co.'s New England marketing division, Boston, has been named sales manager for Humble's Esso Standard region in New York.

▶▶▶ Personals

Phil H. Garrison, district exploration superintendent in New Orleans for Pan American Petroleum Corp., has been promoted to Rocky Mountain division exploration superintendent. He succeeds **L. C. Adams,** who recently was named manager of exploration with headquarters in Tulsa. Garrison has been with Pan Am and predecessors since 1939. He served as division geophysical supervisor in Oklahoma City and Calgary and manager of domestic geophysical operations in Tulsa before being assigned to New Orleans in 1959.

GARRISON

Roger W. Stoneburner, former vice president and manager of exploration for San Jacinto Oil & Gas Co., has been named manager of exploration for Southern Natural Gas Co. He will headquarter in Houston.

W. H. Carruth, manager of bulk sales for DX Sunray Oil Co., has been named general sales manager for Suntide Refining Co. He succeeds **E. W. Patterson,** who recently resigned. **R. C. Sikes,** coordinator of supply and transportation for DX Sunray, will succeed Carruth as bulk-sales manager. Carruth will be in charge of sales of gasolines, distillates, fuel oils and petrochemicals produced at Suntide's Corpus Christi, Tex., refinery. He will continue to headquarter in Tulsa.

W. E. Harpst, manager of Shell Oil Co.'s exploration and production-mechanical engineering department in New York, has been transferred to Midland, Tex., as area production manager. He succeeds **E. N. Van Duzee,** who has retired after 34 years with Shell. **W. M. Koch,** assistant plant superintendent of Shell's Wasson gasoline plants, Denver City, Tex., has been promoted to superintendent of the TXL gasoline plant, Notrees, Tex. He succeeds **W. L. Covington,** who has moved to the Midland area gas department as gas engineer.

▶▶▶ Personals

Officers Elected by Denver SPE Section

NEW CHAIRMAN of the Denver section of AIME's Society of Petroleum Engineers is Fred Poettmann, left, Ohio Oil Co. He succeeds John Ferry, right, Denver-U. S. National Bank. Ferry has been named a director. W. R. Smith, center, Colorado Oil and Gas Conservation Commission, has been elected first vice chairman. Other new officers include James Roe, Lufkin Machine & Foundry, second vice chairman; J. A. Mullinax, Schlumberger Well Surveying Corp., secretary-treasurer; and L. B. Curtis, Continental Oil Co., director.

J. Howard Marshall has resigned as executive vice president of Signal Oil & Gas Co. to become president of Union Texas Natural Gas Corp. Marshall succeeds **Richard T. Lyons,** who retired January 1. Lyons will continue as a director and executive committee member. Marshall has been a director and vice president of Signal since 1952 and executive vice president since August 1959. He previously served as president of Ashland Oil & Refining Co. and from 1941 to 1944 was chief counsel and assistant deputy administrator of the Petroleum Administration for War. Marshall also was elected a director and member of the executive committee, which includes **John T. Oxley,** who will continue as executive vice president in charge of the natural-gas-liquids division.

MARSHALL

Harold A. McGurty, assistant to the director and vice president, exploration and production, for Standard Oil Co. of California, has retired after nearly 50 years with the company. He will be succeeded by **M. N. Stephens,** analytical staff assistant to the director and vice president, exploration and production.

W. W. Butler, geophysicist with Tidewater Oil Co., has been transferred to Houston from Calgary.

E. E. Fickinger, Continental Oil Co., has been elected president of Permian Basin Geological Society, Midland, Tex. Other officers will be **J. J. Eckstrom,** TXL Oil Corp., first vice president; **M. R. Hewitt,** Pan American Petroleum Corp., second vice president; **M. D. Nunnally,** Seismic Explorations, Inc., treasurer; and **G. E. Parker,** Empire Geophysical, Inc., secretary.

Jack B. Ryan, with Jake L. Hamon, oil producer, has been elected president of Abilene, Tex., Geological Society. Other officers are **Harold C. Beaird,** Lone Star Producing Co., vice president; **Doyle H. Elich,** Champlin Oil & Refining Co., secretary; **Jimmy W. Sojourner,** West Central Drilling Co., treasurer; **Kent Waddell,** Coastal States Gas Producing Co., representative to Southwestern Federation of Geological Societies; and **Robert B. Vickers,** Texas Pacific Coal & Oil Co., alternate representative.

Daniel M. Bailey, a vice president of Continental-Emsco Co., has joined Southern Union Gas Co., Dallas, as an executive vice president.

Walter Gardner, geologist with Arkansas Fuel Corp., Lafayette, La., has been transferred to the Houston office, marine district, of Cities Service Oil Co.

John W. McCulley, division marketing manager in Houston for Continental Oil Co., has been promoted to assistant manager of marketing for the southwestern region, Fort Worth. He succeeds **R. R. Jenkins,** who recently was named director of market research in Houston.

Dr. T. J. O'Donnell, director of the geophysical-research division of Gulf Research & Development Co.'s Harmarville, Pa., laboratory, has been named associate director of research, Harmarville. He will direct all activities of the exploration-research department. O'Donnell has been with Gulf Research since 1933. He had headed geophysics operations at the laboratory since 1954.

G. W. Breuer, president of Breuer & Curran Oil Co., has been named executive vice president in charge of exploration and production for Alco Oil & Gas Corp. Breuer & Curran and Alco have been merged with Alco as the surviving company. **Albert D. Farwell, William R. Dickinson, Jr., John E. Ott,** and Breuer, directors of Breuer & Curran, have been named to the new Alco board.

Robert C. Dunlap, Jr., has been elected vice president of Texas Instruments, Inc. He will continue as president of Geophysical Service, Inc., Texas Instruments subsidiary. Dunlap succeeds **Fred J. Agnich,** who has resigned as vice president but will continue as a director of the company.

Judson D. Sweet, exploitation engineer with Shell Oil Co., has been transferred to Billings, Mont., from Oklahoma City.

Willie Joe Kostka, Pure Oil Co. petroleum engineer, has been transferred to Victoria, Tex., from Dickinson, Tex.

A. J. (Jake) Napier, district geologist for Sohio Petroleum Co. in Houston, has opened offices in Lafayette, La., as independent geologist.

Samuel E. Charlton, manager of Humble Oil & Refining Co.'s Pennsylvania sales division, has been named assistant manager of Humble's Oklahoma-Pate area. He will headquarter in Chicago. **DuVal F. Dickey,** assistant manager of the Pennsylvania division, will succeed Charlton there. **Carroll P. Toler,** dealer-merchandising manager for the Esso Standard Virginia - West Virginia sales division, will succeed Dickey.

Eugene W. Kane has been named supervisor of the project-analysis division in the crude-oil planning department of Standard Oil Co. (Ind.). Kane had been a group leader in the Whiting, Ind., research and development department.

John W. Timmins, Dallas, special counsel on foreign operations in Sun Oil Co.'s production department, has retired after 41 years with the company. Timmins was southwest production division general attorney before becoming special counsel in 1956. **Fred E. Buchanan,** administrative assistant to the management of Sun's Gulf Coast production division in Beaumont, Tex., has been promoted to executive assistant to the division manager there.

▶▶▶ Personals

Daniel R. Toll, assistant to the president and manager of exploration for Helmerich & Payne, Inc., and chairman of the executive committee of Engineering - Construction Co., Helmerich & Payne's pipeline-contracting subsidiary, has been elected a vice president of the parent company. Toll was with Lion Oil Co. and the old Deep Rock Oil Corp. before joining Helmerich & Payne.

James D. Murphree, geologist with Pure Oil Co., has been transferred to New Orleans from Shreveport, La.

▶▶▶ Deaths

Col. T. H. Barton, 79, president of Lion Oil Co. for 24 years, died December 24 in El Dorado, Ark., after an apparent heart attack. He had been ill for some time. Barton was a pioneer in the El Dorado oil boom in the 1920's. He was with several firms before joining Lion in 1928 as president. He headed the company until its merger with Monsanto Chemical Co. in 1952. In 1959, the Arkansas Chamber of Commerce cited Barton as a "great living Arkansan" in recognition of his civic activity and philanthropies. He achieved his colonel's title in the cavalry during World War I.

Fred F. Florence, 69, chairman of Republic National Bank, Dallas, died December 25 in a Dallas hospital of a liver ailment. Florence, well known in oil circles, joined a predecessor of Republic National in 1920. He became president of the Dallas bank, now the largest in the South, in 1929.

I. L. Morris, Evansville, Ind., drilling contractor, died December 18 in a Carmi, Ill., hospital.

Dr. Paul P. McClellan, 55, staff associate in research administration for Jefferson Chemical Co., Inc., died December 17 after a heart attack. He joined the company in 1945.

Dwight Tarpenning, 50, Enid, Okla., lease broker, died December 27 in a hunting accident near Fairview, Okla.

C. R. Craft, 71, Evansville, Ind., independent operator, died December 20 in an Evansville hospital.

E. Marshall Harvey, Jr., 60, field operating supervisor for Socony Mobil Oil Co. in Philadelphia, died December 9 in a Camden, Pa., hospital.

Ellis K. Holbert, 67, retired accounting supervisor for Tidewater Oil Co.'s central division, died December 24 at his home in Tulsa after a heart attack. Holbert retired in 1958.

Charles A. Towne, 87, owner of Towne & Towne, Inc., Ada, Okla., oil firm, and founder of Eureka Tool Co., Oklahoma City, died December 26 in Tulsa after a long illness.

Charles O. Whitewell, 42, superintendent of the Prague, Okla., natural-gasoline plant of Kerr-McGee Oil Industries, Inc., and **Cecil Quinn,** 24, roustabout, were killed December 22 in an explosion near the plant.

Charles B. Clothier, 75, former assistant treasurer in charge of financial affairs for Gulf Oil Corp.'s Oklahoma division in Tulsa, died December 27 in Midland, Tex., after a heart attack. Clothier, Tulsa city finance commissioner from 1954 to 1956, was visiting relatives in Midland.

Edward Monroe Humes, 73, owner of Humes Refining Co., Signal Hill, Calif., died December 21 in a Long Beach, Calif., hospital.

Walter Leslie Rippetoe, 65, retired secretary-treasurer of Foster Petroleum Corp., Bartlesville, Okla., died December 23 in a Bartlesville hospital.

Paul E. Bryant, 50, manager of DX Sunray Oil Co.'s refinery accounting department, died December 25 in a Tulsa hospital.

Harlan William Peabody, 79, a director of Wilcox Oil Co., died December 28 at his home in Tulsa. Peabody joined Wilcox in 1945 as geological adviser and consultant. He later was named a director. He retired in 1959 but continued as a director.

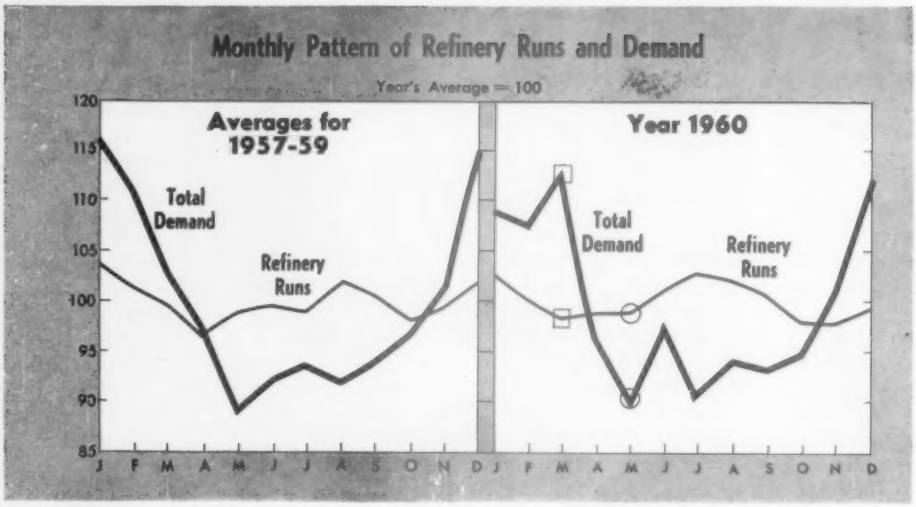


CHART on the left compares seasonal changes in total demand with refinery runs for the 1957-59 period. Since the scale is based on the average for the period equal to 100, points on the lines for any month compared averages for that month with averages for the period.

Right chart shows the comparison between runs and demand for 1960. Note the big demand increase in March accompanied by a decrease in runs. Also, there was no decrease in May runs to offset the big drop in demand.

1960 demand-run pattern was abnormal

BY JOHN C. CASPER

REFINERY RUNS don't always follow the demand pattern, but the variations in 1960 were unusual, even for refiners. Take a look at a few samples.

March was the highest demand month of the year. Total demand averaged 11,121,000 bbl. daily, and that would be a banner month in the middle of the winter heating season. There have been only five 11,000,000-bbl. months in history, and this was the first one for March. Two of the others came in January and the remaining two were credited to December. March demand was 13% above the average for the year. Normal March demand falls about 2% below the average for the year. In this month of high demand, runs dropped 148,000 bbl. daily.

May had the lowest average demand of the year or 8,873,000 bbl. daily. But refinery runs for this low month averaged 7,963,000 bbl. daily for a gain of 46,000 bbl. daily over March.

There was some justification for low runs in March. Demand was a little below normal for the first 2 months of the year, and stock reductions were disappointing. Middle-distillate stocks set an all-time record of 214,236,000 bbl. at the end of October 1959 and dropped only to 178,000,000 bbl. by the end of the year. Small reductions in January and February left 128,000,000 bbl. to start the month of March. This record level was high enough to meet March's abnormal demands without a big boost in runs.

But the advantage gained from high demands and low runs in March was lost in May when refiners increased runs 46,000 bbl. daily over the average for March. May demand was the lowest of the year, but refiners followed the standard pattern of building inventories early in the summer.

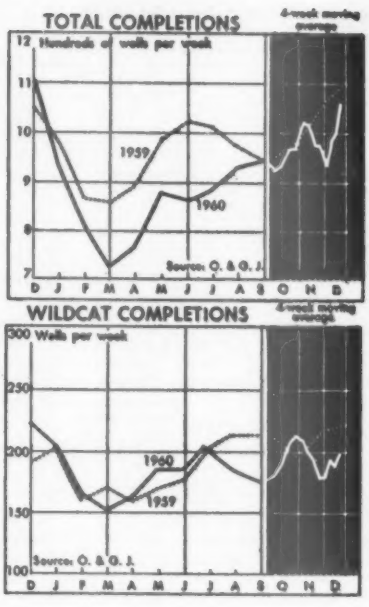
Peak refinery runs for 1960 came in July with an average of 8,307,000 bbl. daily, but July was next to the lowest demand month of the year. High runs and low demand added to the buildup of product inventories. Middle-distillate stocks gained 25,000,000 bbl. in July alone.

The chart on the left gives a picture of runs and demand over the 3-year period from 1957 through 1959. The lines show seasonal patterns for both runs and demand. Points for months compare individual months with average for the year. Total demand ranges from a low of 89.3% in May to 116.0% in January. For refinery runs, the spread is from 96.8 to 103.4% of the year's average. The high-low spread for demand is better than 5 times the difference between high and low of refinery runs.

A quick look at the highlights . . .

	LATEST WEEK	Change from WEEK AGO		Change from YEAR AGO	
Production	7,125,385	UP	985,000	DOWN	81,381
Crude stocks	236,900,000	DOWN	2,369,000	DOWN	19,496,000
Completions	1,205	UP	224	UP	75
Refinery runs	8,009,000	UP	82,000	DOWN	257,000
Gasoline stocks	191,323,000	UP	1,364,000	UP	7,278,000
Kerosine stocks	32,020,000	DOWN	2,583,000	UP	4,940,000
Distillate stocks	151,095,000	DOWN	8,439,000	DOWN	346,000
Residual stocks	47,207,000	DOWN	1,425,000	DOWN	3,244,000
Four-product stocks	421,645,000	DOWN	11,083,000	UP	8,628,000
Total imports	1,825,000	UP	345,900	UP	87,400

Active Rotary Rigs



	12-26-60	12-19-60	12-28-59
Alabama	7	6	5
Alaska	7	7	(†)
Arkansas	10	9	13
Arizona	1	1	0
California	84	82	87
Land	80	79	80
Offshore	4	3	7
Colorado	24	26	39
Florida	4	4	1
Land	2	2	1
Offshore	2	2	0
Georgia	2	2	0
Illinois	30	43	33
Indiana	13	13	7
Iowa	0	0	1
Kansas	123	130	139
Kentucky	4	5	10
Louisiana	280	272	297
North	38	31	32
S. Inland waters	97	97	113
S. Land	94	96	98
Offshore	51	48	54
Michigan	28	31	41
Mississippi	59	60	77
Missouri	1	2	1
Montana	31	32	22
Nebraska	23	22	29
Nevada	1	1	0
New Mexico	108	98	113
New York	1	2	0
North Dakota	15	17	30
Ohio	6	5	3
Oklahoma	194	201	194
Oregon	1	1	0
Pennsylvania	13	13	14
South Dakota	0	0	4
Tennessee	1	1	0
Texas	666	630	655
S. Inland waters	7	9	6
S. Land	184	176	175
Offshore	3	2	0
North	69	63	165
Panhandle	57	54	(*)
East	46	48	(*)
West Central	‡174	‡151	210
West	126	127	99
Utah	32	31	30
Washington	1	1	1
West Virginia	6	6	4
Wisconsin	1	1	0
Wyoming	68	73	63
Total U. S.	**1,845**	1,828	1,913
Western Canada	171	182	222
Eastern Canada	0	0	1
Grand total	2,016	2,010	2,136

Hughes Tool Co. report. *Included in North. Comparisons not available due to change in method of reporting. †Data first reported 4-4-60. ‡Shephens and Eastland counties now included in West Central Texas.

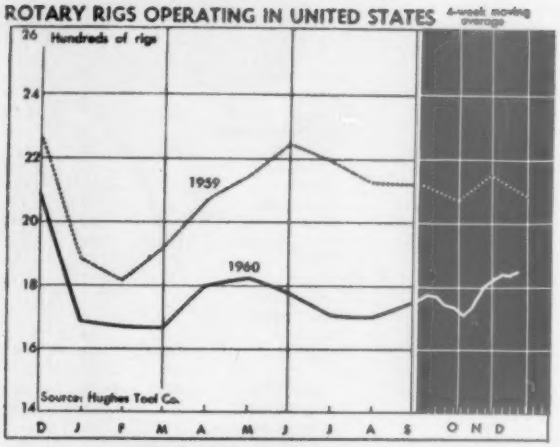
WEEKLY WELL COMPLETIONS . . . WEEK ENDED DECEMBER 24, 1960

	Total wells							Cum.		Total wildcats					Cum.	
	Total	Crude	Cond.	Gas	Dry	Service	Footage	1960	1959	Total	Crude	Cond.	Gas	Dry	1960	1959
Arkansas	12	8	0	2	2	0	37,543	608	842	0	0	0	0	0	144	146
California	50	44	0	2	4	0	99,132	1,729	1,529	5	2	0	2	1	302	404
Colorado	30	3	1	4	22	0	84,021	692	785	20	1	0	0	19	350	443
Illinois	66	24	0	0	24	18	124,945	2,343	2,332	15	1	0	0	14	493	388
Indiana	28	8	0	0	20	0	36,168	1,050	865	9	0	0	0	9	365	296
Kansas	176	93	0	13	57	13	335,210	4,187	3,912	23	2	0	0	21	1,037	1,052
Kentucky	80	49	0	4	27	0	93,968	2,164	3,323	4	0	0	1	3	221	373
Louisiana	77	47	7	2	21	0	575,754	3,665	3,780	11	0	1	0	10	549	504
North	31	17	0	1	13	0	91,880	1,452	1,517	6	0	0	0	6	268	235
South	40	26	7	0	7	0	422,465	1,728	1,853	5	0	1	0	4	247	254
Offshore	6	4	0	1	1	0	61,409	485	410	0	0	0	0	0	34	15
Michigan	0	0	0	0	0	0	0	908	644	0	0	0	0	0	251	180
Mississippi	11	6	1	0	4	0	86,339	674	645	2	0	0	0	2	261	283
Montana	10	1	0	1	8	0	40,024	343	343	6	0	0	1	5	164	119
Nebraska	21	4	0	0	17	0	106,765	869	894	11	1	0	0	10	378	401
New Mexico	27	14	0	8	5	0	138,676	1,827	2,091	2	1	0	0	1	250	261
West	14	5	0	8	1	0	80,899	671	908	1	0	0	0	1	70	65
East	13	9	0	0	4	0	57,777	1,156	1,183	1	1	0	0	0	180	196
New York	0	0	0	0	0	0	0	302	279	0	0	0	0	0	43	22
North Dakota	0	0	0	0	0	0	0	275	432	0	0	0	0	0	80	82
Ohio	22	16	0	3	3	0	50,446	1,080	1,102	3	0	0	2	1	55	38
Oklahoma	121	80	0	7	24	10	274,202	4,713	5,303	11	2	0	2	7	696	827
Pennsylvania	48	12	0	17	7	12	126,562	882	581	2	0	0	0	2	18	21
Texas	356	196	15	13	114	18	1,539,896	15,401	18,520	62	4	1	1	56	3,142	3,523
Dist. 1	24	19	0	0	0	5	46,737	1,102	1,077	5	0	0	0	5	383	329
Dist. 2	15	2	2	2	9	0	99,871	749	797	5	0	0	0	5	185	233
Dist. 3	20	11	0	0	9	0	135,260	1,155	1,192	4	0	0	0	4	222	234
Dist. 4	32	7	3	2	19	1	224,258	1,064	1,340	9	0	0	0	9	295	355
East	40	18	2	0	20	0	179,343	1,298	1,246	11	0	0	0	11	269	252
Dist. 7-B	54	32	1	5	16	0	148,933	2,205	2,625	10	1	0	1	8	622	694
West	92	64	3	3	19	3	481,199	3,941	5,491	12	2	0	0	10	630	744
Dist. 9	52	26	3	0	16	7	119,925	2,866	3,485	4	1	1	0	2	479	573
Dist. 10	27	17	1	1	6	2	104,370	1,021	1,267	2	0	0	0	2	57	109
Utah	5	1	0	1	3	0	33,767	240	308	3	0	0	0	3	95	88
West Virginia	39	5	0	23	10	1	83,584	875	803	1	0	0	0	1	11	28
Wyoming	20	7	0	2	11	0	124,057	1,056	974	10	0	0	0	10	426	371
Miscellaneous*	6	1	0	0	5	0	15,803	274	254	5	0	0	0	5	190	127
Total U. S.	**1,205**	619	24	102	388	72	4,006,862	46,157	50,541	**205**	14	2	9	180	9,521	9,977
Previous week	981	443	20	96	368	54	4,056,183	.....	.....	171	7	5	5	154	.....	.....
Cum. 1960	46,157	20,933	1,301	3,939	17,318	2,666	188,390,489	.....	.....	9,521	846	112	328	8,235	.....	.....
Cum. 1959	50,541	25,251	1,252	3,732	18,906	1,400	207,347,349	.....	.....	9,977	878	113	329	8,657	.....	.....
Western Canada	41	24	0	6	11	0	191,276	2,261	2,357	9	2	0	2	5	580	656

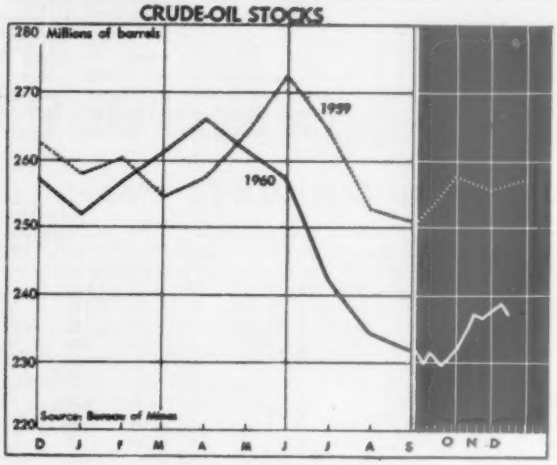
*Washington, Tennessee, Alabama.

PRODUCTION

ROTARY RIGS OPERATING IN UNITED STATES



CRUDE-OIL STOCKS



CRUDE-OIL STOCKS BY STATES OF ORIGIN*
(Thousands of barrels)

	12-17-60	12-10-60	12-19-59
Pennsylvania	2,324	2,308	2,382
Other Appalachian	1,360	1,331	1,986
Illinois, Indiana, Michigan	8,725	8,631	9,743
Nebraska and North Dakota	2,799	2,704	3,214
Kansas	8,813	8,959	10,064
Oklahoma	15,585	14,933	16,580
Arkansas	1,760	1,825	2,066
Louisiana	19,084	19,701	17,998
North	3,176	3,125	3,538
South	15,908	16,576	14,460
Mississippi, Alabama, Florida	1,660	1,916	2,126
New Mexico	8,023	8,434	8,226
Texas	101,673	100,478	112,542
East Texas	7,645	7,595	8,147
West Texas	47,233	47,147	53,596
Texas Gulf	18,230	17,862	21,047
Other Texas	28,565	27,874	29,752
Wyoming	16,917	16,789	17,036
Other Rocky Mountain	10,225	10,240	9,893
California	25,888	26,428	28,698
Foreign	†12,064	14,592	13,842
Total	**236,900**	239,269	256,396

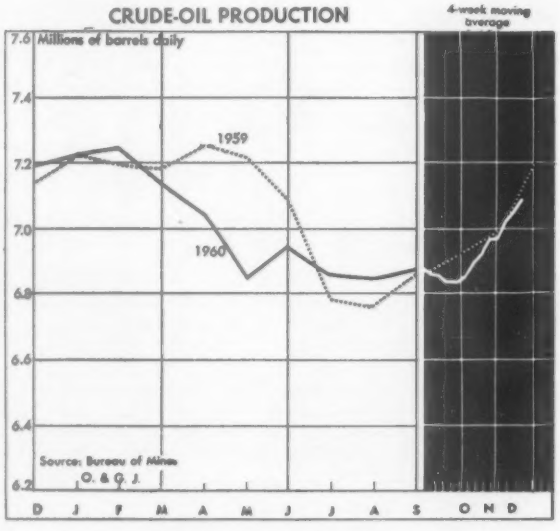
*Bureau of Mines. †Includes 4,376,000 bbl. in California.

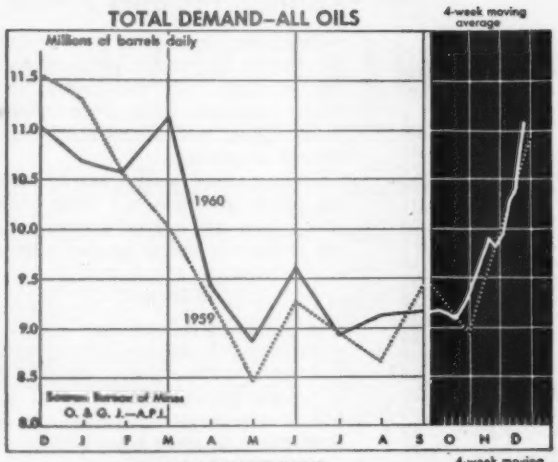
DAILY AVERAGE PRODUCTION FOR WEEK

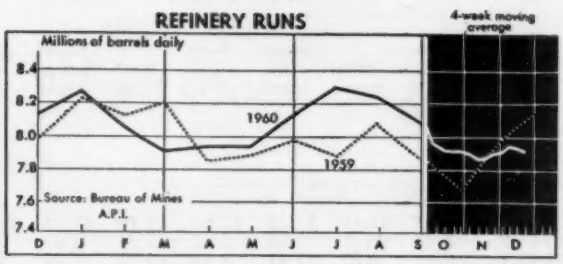
	December 24, 1960 Crude oil	Lease condensate	Total	Dec. 17 total
Alabama	21,500	.....	21,500	21,700
Alaska	5,125	.....	5,125	5,000
Arkansas	74,500	100	74,600	74,575
California	835,600	.....	835,600	834,300
Colorado	131,600	.....	131,600	132,500
Eastern	37,500	.....	37,500	40,200
Florida	875	.....	875	875
Illinois	219,200	.....	219,200	222,400
Indiana	32,700	.....	32,700	32,800
Kansas	†289,510	.....	†289,510	†297,575
Kentucky	59,200	.....	59,200	58,700
Louisiana	968,800	135,000	1,103,800	1,103,600
North	105,800	5,000	110,800	110,600
South	863,000	130,000	993,000	993,000
Michigan	48,500	.....	48,500	48,300
Mississippi	146,775	4,100	150,875	150,875
Montana	79,600	.....	79,600	81,000
Nebraska	64,900	.....	64,900	63,800
Nevada	50	.....	50	50
New Mexico	292,000	8,500	300,500	300,500
North Dakota	70,300	.....	70,300	66,100
Oklahoma	†518,300	.....	†518,300	†509,200
Texas	2,500,000	90,000	2,590,000	2,590,000
Dist. 1	44,000	3,200	47,200	47,200
Dist. 2	108,000	8,300	116,300	116,300
Dist. 3	320,000	38,350	358,350	358,350
Dist. 4	179,000	12,200	191,200	191,200
Dist. 5	27,000	500	27,500	27,500
Dist. 6	109,000	9,800	118,800	118,800
East Texas field	133,000	.....	133,000	133,000
Dist. 7-B	123,000	400	123,400	123,400
Dist. 7-C	117,000	3,150	120,150	120,150
Dist. 8	1,041,000	10,400	1,051,400	1,051,400
Dist. 9	199,000	2,000	201,000	201,000
Dist. 10	100,000	1,700	101,700	101,700
Utah	110,300	.....	110,300	112,800
Wyoming	380,100	.....	380,100	376,800
Others	‡750	.....	‡750	‡750
Total U. S.	6,887,685	237,700	**7,125,385**	7,124,400
Change from prev. week, up	.....	.....	**985**	.....
Canada	.....	.....	.....	†566,700
Total U. S. Prod.—Jan. 1-Dec. 24	.....	.....	.....	2,521,390,300 bbl
Same period last year (crude plus cond.)	.....	.....	.....	*2,524,396,800 bbl.

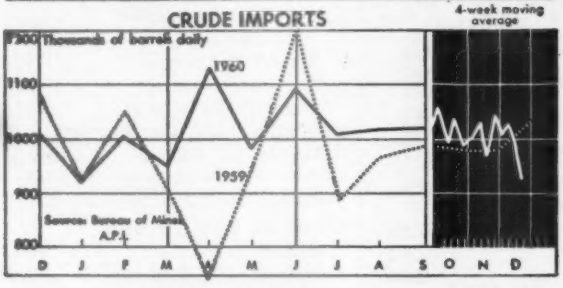
*Includes 68,176,300 bbl. condensate. †Week ended previous Monday. ‡South Dakota and Arizona.

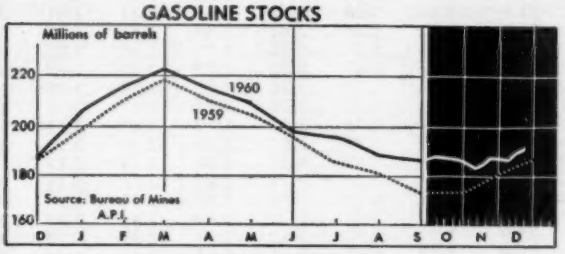
CRUDE-OIL PRODUCTION

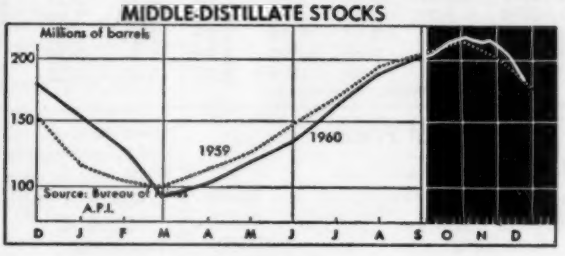


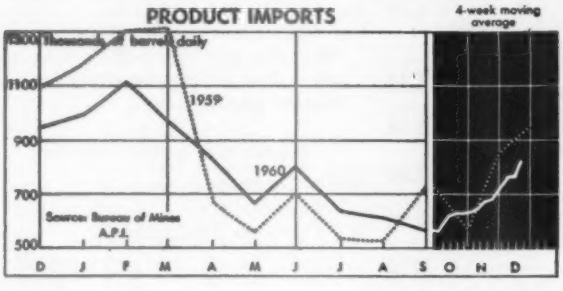


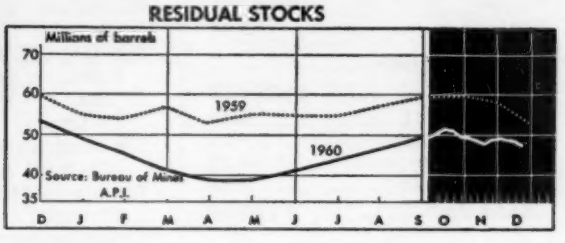












API REFINERY REPORT—DECEMBER 24, 1960

(Thousands of barrels)

District—	Daily avg. runs	Daily average production Gaso.*	Kero.	Dist.	Resid.	Stocks‡ Gaso.†	Kero.	Dist.	Resid.	Bureau of Mines, December 1959 Daily avg. runs	Daily average production Gaso.*	Kero.	Dist.	Resid.
East Coast	1,065	459.6	46.7	345.6	149.3	43,275	12,869	56,980	13,694	1,119	524.9	39.8	359.0	149.4
Appalachian:														
District 1	105	44.6	5.4	26.4	14.4	5,937	688	3,987	506	104	42.9	3.7	23.1	14.8
District 2	99	47.4	8.0	18.3	11.0	2,998	455	1,703	333	110	55.3	7.7	19.5	20.2
Ind., Ill., Ky.	1,515	789.3	83.7	326.3	169.1	30,581	6,565	26,664	6,551	1,548	798.6	82.6	359.4	231.7
Minn., Wis., Dak.	130	62.1	5.4	27.6	21.3	6,684	1,249	7,681	540	121	58.9	5.6	30.7	18.1
Okla., Kans., Mo.	746	425.8	17.7	193.4	30.0	16,855	1,287	13,334	944	699	381.5	15.5	199.5	26.1
Inland Texas	319	213.3	11.7	42.7	17.4	6,802	579	1,584	2,845	291	211.3	9.5	48.5	22.0
Texas Gulf Coast	1,819	984.6	134.2	486.9	133.4	27,388	3,312	15,208	5,703	1,877	980.1	117.9	460.1	154.5
La., Gulf Coast	598	357.6	51.7	142.1	44.6	11,489	2,137	5,327	1,240	714	363.0	87.0	163.5	47.5
N. La. and Ark.	110	62.4	1.7	25.9	6.6	5,245	982	2,536	139	101	46.7	6.7	23.5	8.1
Rocky Mountain:														
New Mexico	22	12.7	0.6	4.0	2.3	820	41	162	16	23	14.2	0.6	4.1	2.3
Other Rky. Mt.	259	141.6	3.9	57.3	27.1	5,701	317	2,698	1,070	293	141.9	3.9	69.6	34.4
West Coast	1,222	570.3	44.7	223.1	284.5	27,548	1,539	13,231	13,626	1,143	534.7	4.8	178.5	277.5
Dec. 24, 1960	8,009	4,171.3	415.4	1,919.6	911.0	191,323	32,020	151,095	47,207	8,143	4,154.0	385.3	1,939.0	1,006.6
Dec. 17, 1960	7,927	4,086.0	422.3	1,846.3	949.1	189,959	34,603	159,534	48,632	.....	.....	.....	.....	.....
Dec. 26, 1959	8,266	4,199.7	393.7	1,886.6	993.0	184,045	27,080	151,441	50,451	.....	.....	.....	.....	.....

*At refineries including natural blended. †Finished and unfinished. ‡At refineries, bulk terminals, in transit, and in pipelines.

Crude-Oil Prices

GRAVITY SCHEDULE

	Signal Hill, Calif.	Oklahoma	West Tex. (sour)	West Tex. (Inter.)	No.* Texas	Texas Refugio Light	Bayou Sale (La.)	Denver Julesburg	Wyo. (sour)
14-14.9	$1.86	....	....	....	....	....	....	....	....
15-15.9	1.93	....	....	....	....	....	....	....	$1.81
16-16.9	2.00	....	....	....	....	....	....	....	1.86
17-17.9	2.06	....	....	....	....	....	....	....	1.91
18-18.9	2.13	....	....	....	....	....	....	....	1.96
19-19.9	2.20	....	....	....	....	....	....	....	2.01
20-20.9	2.27	$2.49	$2.35	$2.61	$2.29	$2.95	$2.90	$2.58	2.06
21-21.9	2.33	2.52	2.38	2.63	2.33	2.97	2.92	2.60	2.11
22-22.9	2.40	2.55	2.41	2.65	2.37	2.99	2.94	2.62	2.16
23-23.9	2.46	2.58	2.44	2.67	2.41	3.01	2.96	2.64	2.21
24-24.9	2.53	2.61	2.47	2.69	2.45	3.03	2.98	2.66	2.26
25-25.9	2.60	2.64	2.50	2.71	2.49	3.05	3.00	2.68	2.31
26-26.9	2.67	2.67	2.53	2.73	2.53	3.07	3.02	2.70	2.36
27-27.9	2.74	2.70	2.56	2.75	2.57	3.09	3.04	2.72	2.49
28-28.9	2.81	2.73	2.59	2.77	2.61	3.11	3.06	2.74	2.54
29-29.9	2.87	2.76	2.62	2.79	2.65	3.13	3.08	2.76	2.59
30-30.9	2.93	2.79	2.65	2.81	2.69	3.15	3.10	2.78	2.63
31-31.9	3.00	2.82	2.68	2.83	2.73	3.17	3.12	2.80	2.67
32-32.9	3.06	2.85	2.71	2.85	2.77	3.19	3.14	2.82	2.71
33-33.9	3.12	2.88	2.74	2.87	2.81	3.21	3.16	2.84	2.75
34-34.9	3.17	2.91	2.77	2.89	2.85	3.23	3.18	2.86	2.79
35-35.9	3.22	2.94	2.80	2.91	2.89	3.25	3.20	2.88	2.83
36-36.9	3.27	2.97	2.83	2.93	2.93	3.27	3.22	2.90	2.87
37-37.9	3.31	2.99	2.86	2.95	2.95	3.29	3.24	2.92	2.89
38-38.9	....	3.01	2.89	2.97	2.97	3.31	3.26	2.94	2.91
39-39.9	....	3.03	2.92	2.99	2.99	3.33	3.28	2.96	2.93
40-44.9	....	3.05	2.95	3.01	3.01	3.35	3.30	2.98	2.95

*Cooke, Grayson, Montague.

Flat Prices

Louisiana:
- Sweet Lake $3.00

Texas:
- East Texas 3.05-3.25
- Conroe 3.23-3.53
- Van 3.08

Pennsylvania Grade:
- Bradford $4.75-4.80
- Middle District 4.52
- Southwest Pennsylvania 4.25
- West Virginia 4.17
- Buckeye Grade 4.08

Illinois Basin **3.00-3.05**

Foreign

Middle East, Persian Gulf:
(cargoes f.o.b. lifting port)
- Arabian, 34.0°-34.9°, Ras Tanura $1.80
- Iranian, 34.0°-34.9°, Bandar Mashur 1.78
- Iranian, 34.0°-34.9°, Abadan 1.73
- Iraq, 35.0-35.9°, Fao 1.72
- Kuwait, 31.0°-31.9°, Mina-al-Ahmadi 1.59
- Qatar, 41.0°-41.9°, Umm Said 1.95

Middle East, E. Mediterranean:
- Arabian, 34.0°-34.9°, Sidon $2.17
- Iraq, Mosul-Kirkuk, 35.0°-35.9°, Tripoli 2.19

Far East (cargoes, f.o.b. Lutong, Sarawak):
- Seria Light, 36° 2.42

Canada:
- Leduc-Woodbend $2.53
- Redwater (Alta.) 2.42
- Weyburn (light) 2.06
- Midale C 1.69

Venezuela:
- Cumbarebo, 47°-47.9°, Tucupido 3.34
- San Joaquin, 40°-40.9°, Puerto La Cruz 3.08
- Oficina, 35°-35.9°, Puerto La Cruz 2.80
- Tia Juana medium, 26°-26.9°, Amuay* 2.30
- Quiriquire, 16.0°-16.4°, Caripito 2.10
- Lagunillas heavy, flat, Las Piedras* 2.10
- Bachaquero, flat, 15°-16°, Las Piedras* 1.88

Prices for all crudes of 24° or lighter vary 2 cents per degree change, up or down. All crudes heavier than 24° vary 2.5 cents per half-degree gravity change.

*Also available at La Salina at 3 cents per barrel less.

Tanker Rates (Long Ton)

(Latest reported spot fixtures)
- ★ Gulf-NY, dirty (ATRS+5%) $2.99
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- ★ Carib.-NY, dirty (ATRS−25%) 2.06
- ★ Carib.-UK, clean (Scale+12.5%) (40s. 8d.) 5.68
- ★ PG-UK, dirty (Scale−25%) (42s. 2d.) .. 5.91

★Denotes change from previous week.

Refined-Product Prices

Following quotations are realistic spot prices for refined products moving interstate on Wednesday each week. They may differ from refiners' posted prices and should not be considered as postings.

Light-product prices are in cents per gallon. Residual and crude prices are dollars per barrel. Crude prices are at the well unless otherwise listed.

Gasoline*

Mid-Continent (Group 3):
- Regular (91 octane) .. 12.25-12.50
- Premium (99 octane) . 15.00-15.25
- Natural gasoline (26-70) 4.5
- Breckenridge 4.0

Gulf Coast (cargoes for coastwise or export movements):
- Regular (90 octane) .. 11.00
- Regular (92 octane) .. 11.25
- Premium (98 octane) . 12.25

California (rack) Los Angeles:
- Regular (88 octane) .. 11.65-12.15
- Premium (94 octane) . 12.65-13.15
- Premium (100 octane) 14.00-14.65

Caribbean area (cargoes):
- Regular (87 octane) .. 10.125-10.25
- Premium (97 octane) . 11.75

*Quotations are for octanes shown. Prices usually vary with octane ratings within the regular, premium, and aviation grades.

Kerosine and Distillate

Mid-Continent (Group 3):
- Kerosine 42-44 .... 10.875
- Diesel oil (58 d.i. and above) 10.50
- Distillate No. 1 .... 10.50
- Distillate No. 2 .... 9.50

Gulf Coast (cargoes):
- Kerosine 41-43 .... 9.25-9.50
- Distillate No. 2 .... 8.50

New York Harbor (barges):
- Kerosine 42-43 .... 10.65
- Distillate No. 2 .... 9.65
- Diesel fuel, 48-52 d.i. 10.05

Caribbean area (cargoes):
- Distillate No. 2 .... 8.125

Residual Fuel (Bbl.)

Mid-Continent (Group 3):
- Residual fuel (max. 1% S) $1.90

Gulf Coast (cargoes):
- Bunker C fuel 2.30

New York Harbor (barges):
- Bunker C fuel 2.52

Caribbean (cargoes):
- Bunker C 2.10

California (rack):
- Bunker C fuel, Los Angeles 2.25

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OIL JOB DIRECTORY, foreign and domestic, showing where to apply for jobs. $5.00 cash OIML Co., Box 2603, Tulsa, Oklahoma.

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PETROLEUM ENGINEER with at least 5 years experience in production engineering, including well sitting, who desires drilling engineering in conjunction with production. Send Complete resume. Box M-212, The Oil and Gas Journal, Tulsa, Okla.

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Geologist, M.S., 35, single, nine years experience surface, subsurface, domestic, foreign. Seeking foreign employment, anywhere, anytime. W. E. Sweet, 2415 Mimosa, Apt. 4-F Houston 19, Texas. Ja 9-3222.

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LEASE AND DRILLING BLOCKS

WORKING INTEREST for sale, 25 acre offset to production. 750 ft. Bartlesville sand. Well drilling, water flood ¼ mile to lease. Box M-196, The Oil and Gas Journal, in Mongtomery Co. Kansas.

OIL LEASE CRANE County, Texas: Available S/239 acres, Section 18, Block B-28, PSL, two miles from new gas discovery Section 23, Blk. 4, H&TC, Hill & Meeker well. Quick action, address landowner: Jefferson G. Smith, 715 Littlefield Building, Austin 15, Texas.

SECONDARY RECOVERY in Kevin-Sunburst oil field in Montana. Cores indicate 10,000 to 20,000 barrels oil per acre reserves at 1,600'. One large company now starting flooding operations. We have 900 acres in solid block that is proven. This is not an offer for sale. Imperial-Craig Co., Kevin, Montana.

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FOR SALE—250 acres non producing royalty in Ellis County Oklahoma. 11 new fields opened in 1960 in county and nine active locations now. Have sold 300 to date. Also 184 acres in Hemphill County Texas. New well just north completed by Mobil. Walter L. Gray CE 6-5405 or Box 812 Oklahoma City, Oklahoma.

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CAPITAL NEEDED to drill offset production in Ohio and W. Va. Oil bringing 4.17 per BBL., Gas 25 cents per thousand. David W. Law 716 Union Trust Bldg., Parkersburg, W. Va. Phone HU 5-6446.

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LEGAL

CALIFORNIA INDIAN LANDS, FOR OIL & GAS LEASE. Two tracts of land in Colusa County, California, totaling approximately 268 acres, are being advertised for oil and gas lease sale. The property is the trust land of the Colusa Indian Community, and full information may be obtained from the BUREAU OF INDIAN AFFAIRS, P. O. BOX 749, SACRAMENTO 4, CALIFORNIA, Phone: IVanhoe 3-6441.

LEGAL

SALE OF OIL AND GAS MINING LEASES, TRIBAL AND ALLOTTED INDIAN LANDS, DEPARTMENT OF THE INTERIOR BUREAU OF INDIAN AFFAIRS, Fort Peck Indian Agency, Poplar, Montana. Sealed bids will be received until 10:00 A.M. Mountain Standard Time, January 17, 1961, and opened at that time at the Fort Peck Indian Agency, Poplar, Montana, for the leasing of 73 tracts of Tribal land comprising 10,219.25 acres and 125 tracts of individually owned trust or restricted Indian lands comprising 29,922.17 acres located in Roosevelt County, Montana for oil and gas mining purposes. Details of the lease offering and how and where to file bids may be obtained by addressing the inquiry to the Superintendent, Fort Peck Indian Agency, Poplar, Montana, or telephone Poplar, PO 8-3441.

LEGAL

U. S. DEPARTMENT OF THE INTERIOR, Bureau of Land Management, Santa Fe, New Mexico. Notice is hereby given that approximately 5,567.35 acres of land in twenty-seven parcels within the known geologic structure of certain fields in Eddy, Chaves, Lea, Rio Arriba, Sandoval and San Juan Counties, New Mexico, will be offered for oil and gas leasing through competitive bidding to the qualified bidder of the highest cash amount per acre at 2:00 p.m., MST, January 17, 1961, when bids will be opened. Details of the lease offering, how and where to submit bids, may be obtained from the Bureau's Land Office at Santa Fe, New Mexico. Douglas E. Henriques, Manager.

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(Continued from page 132)

NORTH TEXAS

Cooke County:

Walnut Bend, Canyon sand field. Sinclair Oil & Gas Co. 5 W. T. Montgomery, OWPB, Robert Finley Sur. A-389. IPF 178 BOPD, 16/64-in. choke, plus 15% water, CP 30 psi., TP packer, 38°, Canyon 2,440-42 ft. TD 5,188 ft. PB 4,192 ft. New oil discovery.

Grayson County:

New Mag 16,000-ft. Oil Creek sand field. Standard Oil Co. of Texas 1 Mary I. McAdams 3, 2 miles west of Pottsboro in Sec. 35, W. B. Chiles Sur. A-296. IPAOF 4 M.M.c.f.d., SITP 8,001 psi., GLR 35,700:1, 54.6°, pay 16,275-16,540 ft. Deepest producer in North Texas, second deepest in state. TD 16,555 ft. New gas discovery.

WEST TEXAS

Crane County:

Thomas C. Brown et al. 1 Louise Jones, 11 miles south of Crane in H. T. Sapp Sur. 6, IPF 264 BOPD, plus 30% water, 21/64-in. choke, 45.5°, GOR 600:1. TP 500 psi. CP 100 psi. Devonian 6,120-25 ft. TD 6,140 ft. New oil discovery.

Schleicher County:

Thomas & Duffield Drilling Co. 1 E. M. Jackson, 15 miles southwest of Eldorado in Sec. 69, Blk. K, GH&SA Sur. IPF 22 BOPD, plus 2% water, 8/64-in. choke. 39°, GOR 1,840:1. TP 75 psi., Pennsylvanian 5,611-17 ft. TD 5,701 ft. New oil discovery 2½ miles south of Page gas field.

Ward County:

Gulf Oil Corp. 1 C. W. Edwards et al., 3 miles southeast of Monahans in Sec. 4, Blk. B-19, PSL Sur. IPF 341 BOPD, plus 5% water, 16/64-in. choke, 36.7°, GOR 2,450:1, TP 1,425 psi., CP 2,195 psi. Leonard 6,520-70 ft. TD 9,647 ft. PBTD 6,998 ft. New oil discovery.

Ohio gets significant find

In Ohio, a significant Clinton wildcat discovery in Smith Township, Mahoning County having a flow of 5,916 M.c.f.d. with rock pressure of 1,410 psi. after fracture has been finaled by Atlas Exploration Corp. on 1 Russ Miller, Section 4.

This test, about 11 miles from Clinton production found the sand at 4,880-4,926 ft. with a good pay section, gaging 500 M.c.f.d. natural.

Drilling is under way on a follow-up about 1 mile northeast in Lot 24 of Deerfield Township, Portage County on E. L. Longties.

Also, in the same general area of the state, Northern Natural Gas Production Co. have indications of a pool opener in Freedom Township, Portage County. The test, 1 E. Moore, Lot 79, found the Clinton sand at 4,322-60 ft. with a natural gage of 184 M.c.f.d. Reported flow was 342 M.c.f.d. with 2 bbl. of oil after fracture treatment and rock pressure 1,270 psi.

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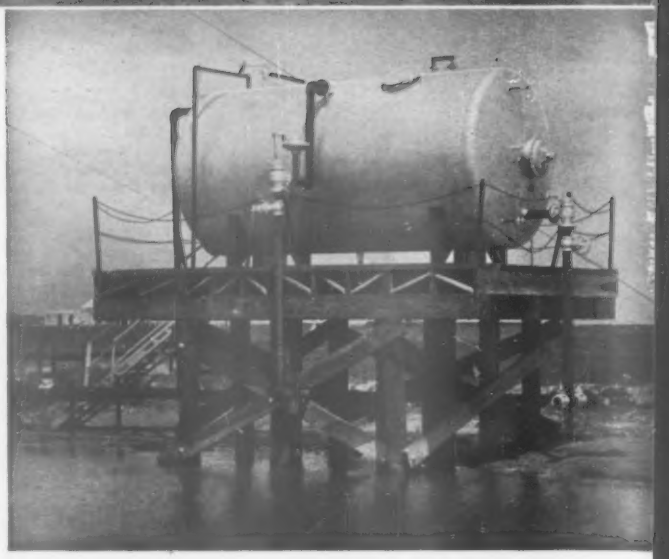

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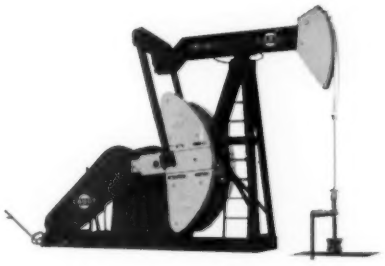

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